

NUCLEAR SCIENCE ABSTRACTS

Volume 9

November 30, 1955

No. 22

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GENERAL

RESEARCH PROGRAMS

7223

MAJOR ACTIVITIES IN THE ATOMIC ENERGY PROGRAMS, JANUARY-JUNE 1955. Washington, U. S. Government Printing Office, July 1955. 160p. \$0.50.

Activities in atomic energy programs for Jan.-June 1955 are summarized. The main developments in the atoms-for-peace program are also discussed. Activities discussed include the production of raw materials, military applications, community operations, reactor development, physical research, biology and medicine, and civilian applications. (B.J.H.)

BIOLOGY AND MEDICINE

7224 UCRL-2124(Rev.)

California. Univ., Berkeley. Radiation Lab. CHEMICAL EVOLUTION AND THE ORIGIN OF LIFE. Melvin Calvin. Aug. 11, 1955. 23p. Contract W-7405-eng-48.

A discussion is presented of the elements, or at least most of the elements, that are usually thought of as required and characteristic of living materials. A continuous evolutionary process is conceived, beginning with a bare earth and leading to the random formation of more or less complex molecules from simple ones, and gradually, by the processes of random variation, autocatalysis, and selection, to more complex systems and the ordered array of desoxynucleic acid molecules which are the units that carry the continuity and order of present-day living systems. (auth)

7225 AERE-Lib/Trans-554

NEW RESULTS ON THE STRUCTURE OF COLLAGEN. A. A. Tustanovskii, A. L. Zaides, G. V. Orlovskaya, and A. N. Mikhailov. Translated by J. B. Sykes from *Doklady Akad. Nauk S.S.S.R.* 97, 121-4(1954). 5p.

7226

CANADIAN CANCER CONFERENCE. VOLUME I. PROCEEDINGS OF THE FIRST CANADIAN CANCER RESEARCH CONFERENCE, HONEY HARBOUR, ONTARIO, JUNE 16-19, 1954. R. W. Begg, ed. New York Academic Press, Inc., 1955. 443p.

Topics discussed at this conference include experimental tumors, tumor-host relationships, cancer of the lung, enzymes, and applications of ionizing radiations in the induction and therapy of tumors. (C.H.)

7227

BORON UPTAKE IN MOUSE BRAIN NEOPLASM. P. Gerald Kruger (Univ. of Illinois, Urbana and Brookhaven

National Lab., Upton, N. Y.). *Radiation Research* 3, 1-17(1955) Sept.

7228

PRENATAL INGESTION OF FLUORIDES AND THEIR TRANSFER TO THE FETUS. Reuben Feltman and George Kosel (Passaic General Hosp., N. J.). *Science* 122, 560-1(1955) Sept. 23.

Fluorides were ingested in several forms by women in various stages of pregnancy. The average fetal blood concentration of the study groups was much higher than that of the control groups. This marked difference does not appear in the placentas. (B.J.H.)

RADIATION EFFECTS

7229 AMRL-202

Army Medical Research Lab., Fort Knox, Ky. THE THEORY OF INTERMITTENT RADIATION EFFECTS ON CHEMICAL AND BIOLOGICAL SYSTEMS. II. BIOLOGICAL SYSTEMS. Richard W. Michie and Lawrence H. Krohn. June 17, 1955. 26p. Project No. 6-59-08-014.

The mathematical theory developed in a previous study for the effects of intermittent radiation on chemical systems is extended to biological systems. The fundamental postulate which permits this extension assumes that the response of a biological system to radiation can be looked upon in terms of chemical reactions. The theory is then compared to existing experimental information. (auth)

7230 AMRL-207

Army Medical Research Lab., Fort Knox, Ky. APPLICATIONS OF INTERMITTENT RADIATION THEORY TO CONSTANT DOSE VARIABLE RADIATION TIME PROBLEMS IN BIOLOGICAL SYSTEMS. Richard W. Michie and Lawrence H. Krohn. July 21, 1955. 26p. Project No. 6-59-08-014.

The mathematical formulation of the intermittent radiation effects on biological systems is extended to problems involving constant dose and variable radiation time. The derived expressions produce curves which show a non-linear dependence of the effectiveness (proportional to the number of organisms killed) on the radiation time. The theory indicates the possibility that fewer organisms may be killed under a very high dose rate for a short exposure time as compared to a low dose rate at a long exposure time for a constant total dose. (auth)

7231 UCRL-3055

California. Univ., Berkeley. Radiation Lab. THE EFFECT OF PHYSIOLOGICAL AND MORPHOLOGICAL CHANGES ON THE RADIATION SENSITIVITY OF *ESCHERICHIA COLI*. Arnold Stanley Brownell. July 1955. 104p. Contract W-7405-eng-48.

Escherichia coli, strains B and B/r, were grown aerobically in three different culture media. Sensitivity of these cells to x rays and ultraviolet light was determined at various stages of their growth cycle. Effects of both pre-

and post-irradiation cultural conditions on the lethal effects of x rays were investigated. Types of culture medium and "physiological age" of the organisms were determinants in the x-ray sensitivity of this organism. The resistance of strain B/r to x irradiation increased during lag phase when cultured in nutrient broth. Throughout this period survival curves were exponential. The shape of survival curves changed to sigmoid type with the onset of cellular division, the slope progressively increasing during logarithmic phase. When the organisms were grown in synthetic medium their survival curves were sigmoid with increased slope early in lag phase. The slope and shape of the curves were essentially constant throughout the remaining period of logarithmic growth. X-ray survival curves of population of cells having different average numbers of nuclear bodies per cell were determined for strain B/r cells grown in nutrient broth and in synthetic medium. The addition of glucose to nutrient broth produced anomalous results. Several possible explanations to account for the differences noted were discussed. The experimental results were not sufficient to invalidate the hypothesis of nuclear inactivation. Partial recovery was effected when x-irradiated strain B/r cells grown in nutrient broth were incubated in the presence of certain nutrients and at temperatures suboptimal for growth. It was found that actively growing cells were capable of greater recovery than "resting" cells. Synthetic medium grown cells were unable to effect this recovery to any appreciable extent. Preliminary experiments indicated that insufficient iron in the synthetic medium may have been an important factor in the loss of the recovery phenomenon. The sensitivity of strain B and B/r to ultraviolet light was followed through lag and logarithmic phases of growth in nutrient broth. Similarities, as well as striking differences, in ultraviolet light inactivation of the two strains were noted. (auth)

7232 UCRL-3096

California. Univ., Berkeley. Radiation Lab.
MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT
[FOR] APRIL, MAY, JUNE 1955. July 26, 1955. 37p.
Contract W-7405-eng-48.

Data are reported from the following studies: the influence of thyroxine on the toxicity of At^{211} in rats; the bone deposition of injected Ce^{144} , $Eu^{152,154}$, Th^{140} , and Tm^{170} in rats; chromatographic determination of carbonyl compounds; glycine radiolysis; polypeptide radiolysis; the effect of mercaptoethylamine on red cell formation in irradiated rats as shown by increased Fe^{59} uptake; the influence of ploidy and division stage on the anoxic protection of *Saccharomyces* against x-ray inactivation; the incorporation of P^{32} into DNA of normal and irradiated Ehrlich ascites tumor cells; and the influence of fasting on the incorporation of P^{32} into DNA. (For preceding period see UCRL-3013.) (C.H.)

7233 USNRDL-TR-53

Naval Radiological Defense Lab., San Francisco.
URINARY EXCRETION AND PLASMA LEVELS OF FREE
NINHYDRIN-REACTIVE COMPOUNDS IN X-IRRADIATED
RATS. R. E. Kay, D. C. Harris, and C. Entenman. Aug.
4, 1955. 13p. Project No. NM 006 015.

An investigation was made of the source of liver glycogen in the irradiated rat. The daily urinary excretion and plasma concentration of ninhydrin-reactive compounds in fasting, x-irradiated rats were measured by the paper

chromatographic method and data are tabulated on 15 amino acids. (C.H.)

7234 USNRDL-TR-54

Naval Radiological Defense Lab., San Francisco.
THE CONVERSION OF GLYCINE-1- C^{14} TO PROTEIN-C
AND $C^{14}O_2$ IN LIVER SLICES FROM X-IRRADIATED RA
R. E. Kay and C. Entenman. Aug. 1, 1955. 19p. Proje
NM 006-015.

The effects of whole-body x irradiation upon protein synthesis in rat liver were investigated. The net incorporation of C^{14} from glycine-1- C^{14} into protein of liver slices was greater for x-irradiated, fasted rats than for fasting control rats. The incorporation in control rats falls off the fast progresses. In contrast, the incorporation in x-irradiated rats increases with increasing time after irradiation and length of fast. The rate of conversion of glycine-1- C^{14} to $C^{14}O_2$ is not the same for liver slices from x-irradiated and control rats. After a 1-day fast the liver slices from the control rats convert 18 to 28% of the glycine label to $C^{14}O_2$. This rate increases to a peak value of 26 to 45% after 2 days of fasting and declines to 16 to 21% at the end of 3 days of fasting. In the irradiated rat, conversion is 20 to 30% after a 1-day fast and this amount rises steadily to 21 to 37% at the end of a 3-day fast. (auth)

7235

MODIFICATION OF X-RAY MUTAGENESIS IN DROSOPHILA
I. REUNION OF CHROMOSOMES IRRADIATED DURING
SPERMIOGENESIS. I. I. Oster (Indiana Univ., Bloomington). *Genetics* 40, 692-6(1955) Sept.

The ends of chromosomes broken during spermiogenesis undergo reunion before fertilization while the breaks produced in mature spermatozoa remain open and reunite during fertilization. In these stages of germ cell development prior irradiation does not lead to an alteration in the reactions to subsequent doses of x-rays. (auth)

7236

A COMPARISON OF X-RAY AND ULTRAVIOLET EFFECTS
ON CHROMOSOMES OF ZEA MAYS. M. H. Emmerling
(Univ. of Missouri, Columbia). *Genetics* 40, 697-714(1955) Sept.

A cytological analysis was made of the effects of ultraviolet radiation and x rays on chromosomes 9 to 10 of *Zea mays*. A stock homozygous recessive for the gene *b* in the short arm of chromosome 9, and a stock with the gene *r8* in the long arm of chromosome 10 were pollinated by irradiated pollen from stocks homozygous dominant for the two marker genes and the knob. The F_1 plants which exhibited the recessive phenotype for the specific gene markers on chromosomes 9 and 10 were saved for cytological analysis. Analysis of the chromosomal aberrations showed no gross qualitative difference between the effects of ultraviolet and x radiation. However, a quantitative difference was found between the two types of radiation in the frequency distribution of chromosomal alterations. A lower frequency of complex deficiencies and higher frequency of terminal deficiencies occurred in chromosome 9 following treatment with ultraviolet radiation than in chromosome 9 following x-ray treatments. It could not be determined whether this was due to a low rate of coincident breaks, the same frequency of breaks in ultraviolet and x-ray series, but failure of fusion of broken chromosomal ends in the ultraviolet series. (auth)

7237

α -PARTICLE DOSIMETRY AND THE INHIBITION OF

MITOSIS IN THE GRASSHOPPER NEUROBLAST BY LOW DOSE α -IRRADIATION. Robert W. Rogers (Oak Ridge National Lab., Tenn. and Univ. of Tennessee, Knoxville). Radiation Research 3, 18-37(1955) Sept.

Polonium α -particle sources and a microscope-adapted source holder were utilized for irradiating special mica hanging-drop living culture preparations of grasshopper embryos. A single-crystal zinc sulfide scintillation-photomultiplier technique was developed and employed for measuring α -particle traversal of single biological cell dimensions with improved dosimetry. Studies were made of polonium sources comparing scintillation, photographic, and mathematical techniques in measurement of the aberrant effects of nonuniform polonium deposition. The ranges of polonium α -particles in air and mica were determined, and the α -particle energy delivered to biological material was graphically computed. The scatter of α -particles in mica, the spatial distribution of particles, the random emission, and the Poisson dose distribution were studied. The effects of 56 rads of α -radiation on the mitotic rate of grasshopper neuroblast cells were determined, only 75% of normal mitotic activity being observed 6 hours after irradiation. Comparison with similar studies of β - and x-ray inhibition indicated that α -particles were most effective and β -particles least effective in producing inhibition of mitosis, with x-rays intermediate. A comparative study of inhibition of the midprophase and late prophase stages of the neuroblast by 6 rads of x-rays and of α -particles showed greater radiosensitivity in early midprophase, the effectiveness of both radiations becoming inappreciable by prometaphase. At this dose level, α - and x radiation effects on early and late midprophase are indistinguishable in terms of mitotic inhibition or failure to inhibit division. A low-dosage α -radiation study of five substages comprising midprophase showed that inhibition of mitosis was related to Poisson distribution of dosage in gross effect, the dose having been administered in 1 second with an average of 0.8 α -particle per second per neuroblast. The effects presumably attributable to a single α -particle were observed, with radiosensitivity decreasing with mitotic progress throughout the midprophase. (auth)

7238
THE INACTIVATION OF DILUTE SOLUTIONS OF CRYSTALLINE CHYMOTRYPSIN BY X-RADIATION. E. Colleen Moore and Margaret R. McDonald (Carnegie Institution of Washington, Cold Spring Harbor, N. Y.). Radiation Research 3, 38-43(1955) Sept.

The rennet and the protease activities of dilute solutions of crystalline chymotrypsin are equally and simultaneously destroyed by x radiation. The inactivation is an exponential function of the radiation dose. The reaction yield increases slowly, but consistently, with increasing concentration of enzyme, varying from 0.50 to 0.85 $\mu\text{M}/\text{l}$ per 1000 r for chymotrypsin solutions ranging from 6×10^{-6} to 3×10^{-4} M. The reaction yields are essentially independent of pH in the range from 9 to 5 but increase with increasing acidity from 5 to 2. (auth)

7239
LETHAL EFFECTS ON RATS OF SINGLE AND MULTIPLE EXPOSURES OF 400-Kv AND 22-Mv X-RADIATION. W. S. Woods, J. B. Fuller, W. J. Henderson, F. Dallenbach, and L. A. Harvey (Univ. of Illinois Coll. of Medicine, Chicago). Radiation Research 3, 44-51(1955) Sept.

Irradiation of rats with single doses of 400-kvp and 22-

Mv x-irradiation showed that the latter is only about 75% as effective when based on the $\text{LD}_{50(30)}$. When rats were irradiated with fractionated exposures of 51 r/day, the lethal effectiveness of 22-Mv x-rays was only 55 to 60% of that of the 400-kv radiation. This may be due to the lower effectiveness of the daily exposure of 22-Mv x rays, which permitted greater recovery. Calculations of the integral dose delivered by 22-Mv x rays is about 106% of the 400-kvp dose. Thus the greater effectiveness of the 400-kv radiation cannot be explained on the basis of dose distribution in the animals. Gross pathological examinations were not conclusive in respect to finding any different response to the two types of radiation. Pulmonary hemorrhages and pneumonia were predominant as the cause of death in both animal groups. (auth)

7240
THE REACTION OF THE MOUSE SPLEEN TO X-RAYS MEASURED BY CHANGES IN ORGAN WEIGHT. Robert F. Kallman and Henry I. Kohn (Univ. of California School of Medicine, San Francisco). Radiation Research 3, 77-87 (1955) Sept.

7241
CLEARANCE OF BACTERIA FROM THE BLOOD OF IRRADIATED RABBITS. Lee L. Gordon, Dorothy B. Cooper, and C. Phillip Miller (Univ. of Chicago). Proc. Soc. Exptl. Biol. Med. 89, 577-9(1955) Aug.-Sept.

Normal and irradiated rabbits were inoculated intravenously with approximately 10^6 *Klebsiella pneumoniae*, Type A. At intervals thereafter plate counts were made on peripheral blood. During the first 4 hours after inoculation the rate of clearance of microorganisms from the blood stream was as rapid and almost as complete in rabbits which had been exposed 1 to 8 days before with 800 r total-body x irradiation ($\text{LD}_{50/30}$) as in unirradiated controls. From the 8th hour on, in most of the rabbits 3 to 8 days post-irradiation, the colony counts increased steadily until the animals died. These findings indicate that in the irradiated rabbit the reticulo-endothelial system was able for a few hours to remove the bacteria from the circulating blood but was unable to retain and destroy them. (auth)

7242
EFFECT OF VARIOUS DOSES OF TOTAL BODY X-IRRADIATION ON TOTAL AMOUNT OF DEOXYRIBONUCLEASE II IN RAT SPLEEN. Carl D. Douglass and Paul L. Day (Univ. of Arkansas, Little Rock). Proc. Soc. Exptl. Biol. Med. 89, 616-17(1955) Aug.-Sept.

The increases in activity of spleen DNase II following a series of different doses of total-body x-irradiation 24 hours after treatment have been measured. These increases have been correlated with the change in spleen weights associated with the irradiation. (auth)

7243
COBALT-INDUCED POLYCYTHEMIA AND SURVIVAL OF X-IRRADIATED ALBINO RATS. Carl F. Gessert and Paul H. Phillips (Univ. of Wisconsin, Madison). Proc. Soc. Exptl. Biol. Med. 89, 651-4(1955) Aug.-Sept.

Cobaltous chloride was incorporated in the diet of rats in the amounts of 0, 10, 20, 40, 70 and 100 ppm of added cobalt for a period of 19 weeks prior to whole-body x-irradiation and 6 weeks after. The various degrees of polycythemia which were thereby induced were measured indirectly by measuring the increases beyond the normal in hemoglobin concentrations. The ratio of the increase in hemoglobin concentration in each polycythemic group to the

normal increase in 14 weeks was found to be directly proportional to the logarithm of the concentration of added dietary cobalt. The rats with cobalt-induced higher concentrations of hemoglobin had an increased average rate of mortality after receiving 750 r whole-body x-irradiation, rather than a decreased rate, as compared with similarly irradiated control rats. Measurements of mucoprotein concentrations in the plasma revealed no significant differences between the various groups before irradiation, nor substantial changes at 48 hours after irradiation. (auth)

7244

STUDIES WITH RADIOIODINE. V. VALIDITY OF HISTOLOGIC DETERMINATION OF I^{131} RADIATION CHANGES IN THE THYROID GLAND. Earl R. Miller, Stuart Lindsay, and Morris E. Dailey (Univ. of California School of Medicine, San Francisco). Radiology 65, 384-93(1955) Sept.

Results are presented from an investigation of the histological changes in thyroid tissue due to radiations from I^{131} and the characteristics which distinguish them from changes attributable to pathological conditions and other causes. (C.H.)

7245

PRODUCTION OF CATARACTS IN ANIMALS BY X-RAYS AND FAST NEUTRONS. P. J. Leinfelder, T. C. Evans, and E. Riley (State Univ. of Iowa, Coll. of Medicine, Iowa City). Radiology 65, 433-8(1955) Sept.

Radiation cataract is a real but not a vital hazard. In most instances it can be avoided by the use of proper precautions. With lower dosages, progressive changes are not as likely to occur as with higher exposures. The development of radiation cataract demonstrates some of the mechanisms of biologic actions of ionizing radiation. Cataract is a more likely hazard for neutron workers than for those who may be exposed similarly to x radiation. (auth)

7246

THE EFFECT OF RADIATION ON THE NUCLEIC ACID, NITROGEN, AND WATER CONTENT OF THE YOSHIDA SARCOMA. Joseph W. Gardella and Eleanor J. Lichtler (Collis P. Huntington Memorial Hospital of Harvard Univ., Massachusetts General Hospital, Boston). Cancer Research 15, 529-31(1955) Sept.

A marked and simultaneous increase in the mean cell volume, RNA, nitrogen, and water content of the Yoshida sarcoma cell was encountered from 17 to 24 hours after exposure to 1,000 r x radiation in vivo. The increase in RNA and nitrogen content per cell was roughly proportional to the increase in cell water, so that the concentration of RNA and nitrogen was not appreciably altered in the irradiated cell. The content of DNA per cell, on the other hand, remained unchanged, so that its concentration fell in proportion to the increase in cell water. The implications of these findings are discussed. (auth)

7247

UNIFORMITY OF IONIZING RADIATION ACTION ON SEVERAL TRANSFORMING FACTORS OF PNEUMOCOCCUS. Julius Marmur and Donald J. Fluke (Rockefeller Inst. for Medical Research, New York and Brookhaven National Lab., Upton, N. Y.). Arch. Biochem. Biophys. 57, 506-14(1955) Aug.

Preparations of transforming pneumococcal DNA have been bombarded with 2 Mev electrons and tested for transforming activity with respect to three drug-resistant factors and one metabolic factor. The results show no difference in

radiation effect among these four factors. There appears to be a dispersion in the radiation sensitivity of transforming activity describable in terms of two radiosensitive molecular weights, one smaller than 1,000,000, and the other larger than 2,000,000. There is further indication that linked transforming factors involve mainly the higher sensitivity. (auth)

7248

SPECULATIONS ON HAZARDS OF EXPOSURE TO RADIATIONS. John Keosian (Rutgers Univ., Newark, N. J.). Sci. 122, 586-7(1055) Sept. 30.

RADIATION HAZARDS AND PROTECTION

7249 UCRL-2689

California. Univ., Berkeley. Radiation Lab.; and California. Univ., Berkeley. Donner Lab.

CONFIRMATION OF RADIOACTIVITY IN THYROIDS OF VARIOUS ANIMALS. [REPORT FOR THE PERIOD] JULY 15 TO SEPTEMBER 10, 1954. Ralph L. Gunther and Hardin B. Jones. Sept. 1954. Decl. May 3, 1955. 12p. Contract W-7405-eng-48.

Appreciable quantities of radioactivity were found in the thyroid glands of cattle obtained from the School of Veterinary Medicine on the Davis Campus of the University of California. This activity followed an 8-day decay and was attributed to I^{131} resulting from the respiration of air containing radioactive material. Preliminary *in vivo* tests on human subjects from the same area show no activity above background in the vicinity of the thyroid. (C.H.)

7250 UCRL-2689(Add.)

California. Univ., Berkeley. Radiation Lab.; and California. Univ., Berkeley. Donner Lab.

CONFIRMATION OF RADIOACTIVITY IN THYROIDS OF VARIOUS ANIMALS. [REPORT FOR THE PERIOD] JULY 15, TO AUGUST 9, 1954. ADDENDUM. Hardin B. Jones. Sept. 1954. Decl. May 3, 1955. 5p. Contract W-7405-eng-48.

Estimations of the radioactive contamination of the atmosphere are made from measurements of activity found in cattle thyroids. This activity is presumed to be from I^{131} in the respiratory air. (D.E.B.)

7251

EMERGENCY RADIATION EXPOSURE CONTROL: DEVELOPMENT OF CRITERIA. Alvin F. Meyer, Jr. (Offutt Air Force Base, Omaha). Am. Ind. Hyg. Assoc. Quart. 16, 210-14(1955) Sept.

Criteria are presented for use in planning operations which require unavoidable exposure to radiation levels above the maximum permissible levels. Available data on the biological effects of radiation are reviewed. (C.H.)

RADIOGRAPHY

7252

ALPHA-PARTICLE AUTORADIOGRAPHY WITH LIQUID EMULSION. John M. Guilbert and John A. S. Adams (Univ. of Wisconsin, Madison). Nucleonics 13, No. 7, 43(1955). July.

Procedures for employing liquid emulsions in α -particle autoradiography are outlined. The technique allows the emulsion and radioactive specimen to remain together during the autoradiographic process. (D.E.B.)

ADIOTHERAPY

253 ACRH-3

Rogonne Cancer Research Hospital, Chicago.
 ANNUAL REPORT TO THE ATOMIC ENERGY
 COMMISSION. Leon O. Jacobson, ed. Mar. 1955. 84p.
 Contract AT(11-1)-69.

A method is described for the insertion of Y^{90} pellets into the hypophysis for destruction of the pituitary gland. Strontium⁹⁰, in the form of yttrium hydroxide, impregnated into Gel-foam and placed extra- or intradurally in normal rats produced necrosis. A sharp border zone appeared at about 75,000 rep. A method is described for using x-ray film to determine the beta-ray dosage in tissue surrounding small point sources. Data from measurements on a number of β sources are included. Therapeutic results are summarized for applications for x radiation from the Van de Graaff generator and γ radiation from the Co^{60} unit. A set of isodose curves are presented which were obtained with the Van de Graaff generator operated at an energy of 2 Mev. These curves show a relationship that enables one to estimate the isodose curves for odd field size. Summaries of papers published during the period are included. (For preceding period see ACRH-2.) (C.H.)

TOXICOLOGY STUDIES

254

AN EXPERIMENTAL STUDY OF THE EFFECTS OF RARE EARTHS ON ANIMAL LUNGS. G. W. H. Schepers, Anthony B. Delahant, and Andrew J. Redlin. Arch. Ind. Health 12, 297-300(1955) Sept.

Two blends of rare earths in which the oxide and fluoride ratios were reversed were introduced into guinea pigs by intratracheal injection. An inhalation study with the mixture having a high rare earth fluoride content is also described. The earths are progressively retained in the lung tissues. Apart from evident deposition of the earths in the lung tissue, no gross pathological changes could be observed in the experimental animals indicating any form of pneumoconiotic fibrosis. (auth)

255

THE BIOLOGICAL ACTION OF RARE EARTHS. I. THE EXPERIMENTAL PULMONARY HISTOPATHOLOGY PRODUCED BY A BLEND HAVING A RELATIVELY HIGH FLUORIDE CONTENT. G. W. H. Schepers. Arch. Ind. Health 12, 301-5(1955) Sept.

When introduced into the lungs of guinea pigs, a blend of rare earths with a high oxide content produced fatal delayed chemical hyperemia in a third of the animals. In those that survived the introduction of the dust, cellular eosinophilia was a prominent feature. Most of the dust was trapped within focal atelectatic areas, and no material chronic cellular reaction or fibrosis occurred in relation to these deposits. (auth)

256

THE BIOLOGICAL ACTION OF RARE EARTHS. II. THE EXPERIMENTAL PULMONARY HISTOPATHOLOGY PRODUCED BY A BLEND HAVING A RELATIVELY HIGH FLUORIDE CONTENT. G. W. H. Schepers. Arch. Ind. Health 12, 306-16(1955) Sept.

When introduced by intratracheal injection, a blend of rare earth compounds dominantly composed of fluorides provokes an acute transient chemical pneumonitis, subacute bronchitis

and bronchiolitis, and residual deposits in relation to which no reaction occurs. The dominant histopathological changes which result progressively from the prolonged inhalation of the rare earth high fluoride dust comprise focal hypertrophic emphysema, regional bronchiolar stricturing, and subacute chemical bronchitis. Pigment is focally retained but provokes no fibrosis or granulomatosis. The results furnish clues concerning the mechanism of coal miners' emphysema. (auth)

CHEMISTRY

7257 AECD-3654

International Minerals and Chemical Corp., Chicago.
 URANIUM PRODUCTION—PROCESS DESIGNS FOR
 LEACHED ZONE PLANTS. VOLUME III. ALUMINA
 RECOVERY SECTION. D. F. Clements, W. B. Williams,
 R. F. McCullough, and E. E. Wrege. Sept. 25, 1953.
 Decl. with deletions Apr. 13, 1955. 71p. Contract
 AT(49-1)-545.

Liquor from the proposed leaching operation is processed to crystallize ammonium alum which is treated with aqueous ammonia to precipitate an alumina hydrate. The alumina hydrate is dried and calcined to produce metallurgical grade alumina. Basic design, plant capitalization and operating costs for the unit processes pertaining to the recovery of alumina are presented in this report. Data are presented for plants designed to produce 450, 225, and 100 tons of uranium per year. Also included are estimates of capital and operating costs for a process which produces an impure alumina product suitable for feed to the Bayer process. In this process, alum is crystallized from the leached zone extract, washed, dehydrated and calcined to produce alumina. The estimates are for a plant producing 450 tons of uranium per year. (auth)

7258 ISC-534

Ames Lab., Ames, Iowa.
 KINETICS OF CHLORIDE EXCHANGE IN AQUEOUS
 CHLORIDE-TETRACHLOROPLATINATE(II) SYSTEM.
 LeRoy F. Grantham and Don S. Martin. June 1954. 39p.
 Contract W-7405-eng-82.

The equilibrium constant has been determined for the reversible aequation of tetrachloroplatinate(II): $PtCl_4^{2-} + H_2O \rightleftharpoons [PtCl_3(H_2O)]^- + Cl^-$. In systems with low $[PtCl_3(H_2O)]^-$ concentrations, the above reaction has been found to be the only mechanism giving an appreciable exchange. An additional exchange was found which was first order in the $[PtCl_3(H_2O)]^-$ concentration, and independent of Cl^- concentration. (C.W.H.)

7259 MCC-1023-TR-118

Delaware. Univ., Newark.
 NEAR INFRARED SPECTRA OF THE BORON HYDRIDES
 AND RELATED TOPICS (thesis). Eugene Jack Levy. June
 1955. 98p. [For Olin Mathieson Chemical Corp. Con-
 tract NOa(s)-52-1023-c].

Infrared and near infrared spectra are reported for boron hydrides, borines, alkyl borates, and related compounds. (C.W.H.)

7260 MCC-1023-TR-135

Delaware. Univ., Newark.
 STUDIES IN THE REACTION OF THE PHENYL BORANES
 (thesis). Wayne Curtis Schar. June 1955. 36p. [For

Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023-c].

Triphenyl borane was treated with reagents capable of being oxidized readily. A phenylborane-benzaldehyde complex has been formed by refluxing the parent compounds. This complex, unlike the stable ammoniates, decomposes rapidly in air. The peroxide degradation of triphenylborane has been found to proceed stepwise through the diphenoxyphenyl borane, in anhydrous medium, to the triphenyl borate. Hydrolysis of the borate yields boric acid and phenol. A mechanism for the oxidation using an electronically deficient oxygen is proposed. The synthesis of various symmetrically substituted boranes with electron attracting groups was attempted. (auth)

7261 MCC-1023-TR-136

Rensselaer Polytechnic Inst., Troy, N. Y.

THE COMPOSITION OF "SODIUM DIBORANE" (thesis). George Erich Stridde. June 1955. 48p. [For Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023-c].

"Sodium diborane" has been prepared by the reaction of diborane with sodium amalgam, and its composition studied by extraction with solvents at or below room temperature. The major product was shown to be sodium borohydride. A smaller fraction comprising roughly one eighth of the total was isolated and is considered to consist of sodium diborohydride and more highly condensed borohydride ions. A mechanism to account for the products obtained, and the stoichiometry observed, is considered. Sodium carriers for the reaction other than mercury were investigated and found unsuitable. (auth)

7262 MCC-1023-TR-137

Saint Louis Univ.

THE REACTION OF BORON TRIFLUORIDE IN DIETHYL ETHER WITH THE DIAMMONIATE OF DIBORANE AND THE REACTION OF BORON TRIFLUORIDE WITH THE PRODUCTS OF A SOLUTION OF SODIUM AND THE DIAMMONIATE OF DIBORANE IN LIQUID AMMONIA (thesis). Cover Carries title: PREPARATION, CHARACTERIZATION AND STRUCTURE OF THE DIAMMONIATE OF DIBORANE. Francis J. Koenig. Feb. 1955. 80p. [For Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023-c].

The diammoniate of diborane reacted with excess BF_3 in ethyl ether to form hydrogen, diborane, and ammoniaboron trifluoride; it reacts with alkali metal in liquid NH_3 to form alkali metal borohydride, aminoborane, and hydrogen. These reactions are shown to be in conformity with the proposed structure formulations. (C.W.H.)

7263 MCC-1023-TR-138

Saint Louis Univ.

THE SYSTEM LITHIUM ALUMINOHYDRIDE-DIETHYL ETHER-TRIMETHYLAMINE. THE PURIFICATION AND ISOLATION OF LITHIUM ALUMINOHYDRIDE (thesis). Patricia A. Cowie. June 1955. 54p. [For Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023-c].

The purification of lithium aluminohydride can be achieved by taking advantage of the differences in solubility among the trimethylamine addition compounds of lithium aluminohydride, aluminum hydride and aluminum chloride in diethyl ether. Similarly, trimethylamine can be purified from small amounts of ammonia, primary and secondary amines by utilizing the fact that these substances react with lithium aluminohydride to form substituted aluminohydrides, whereas trimethylamine does not. (auth)

7264 MCC-1023-TR-148

Saint Louis Univ.

THE REACTION OF LITHIUM WITH THE DIAMMONIATE OF DIBORANE AND RELATED REACTIONS (thesis). Max D. Adams. June 1955. 101p. [For Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023-c].

The chemical reactions of the diammoniate of diborane and related compounds with Li and several inorganic compounds are described. The ammonium borohydride-aminoborane structure, $\text{NH}_4\cdot\text{BH}_2\text{NH}_2\cdot\text{BH}_4$ is proposed for the diammoniate; the reactions of the diammoniate with lithium borohydride and with ammonium chloride support this proposed structure. The behavior of the diammoniate with Lewis acids and bases was also determined. (C.W.H.)

7265 MCC-1023-TR-149

Syracuse Univ., N. Y.

METHODS OF PREPARATION OF PURE BORON. Final REPORT. Virginia A. Russell, Robinson Swift, Aden J. King, and Frank A. Kanda. June 1955. 27p. [For Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023-c].

Boron of a high degree of purity was made from commercial boron (81 to 87% B) by two methods: hydrogen reduction of BBr_3 at 800°C and high-temperature vacuum treatment of commercial boron. (auth)

7266 NP-5757

Chicago. Univ.

HYDRIDES AND BOROHYDRIDES OF LIGHT WEIGHT ELEMENTS AND RELATED COMPOUNDS. Annual Technical Report for the Period August 1, 1954 to July 31, 1955. H. I. Schlesinger and Grant Urry. Aug. 1, 1955. 49p. Project NR-356-255. Contract N6ori-20, T. O. 10.

The reactions of Li with pentaborane, B_5H_9 , in NH_3 (liquid) and in $\text{C}_2\text{H}_5\text{NH}_2$ (liquid) were investigated. Studies were continued on the reactions of diboron tetrachloride, B_2Cl_4 , with unsaturated hydrocarbons and hydrocarbon derivatives. Preparations and chemical reactions of other boron halides are discussed. A grease-free mercury float valve is described. (C.W.H.)

7267 NP-5767

Rutgers Univ., New Brunswick, N. J. School of Chemistry RESEARCH ON BORON POLYMERS. Quarterly Progress Report B-3 [for] June 1, 1955-August 31, 1955. William L. Ruigh, Frank C. Gunderloy, Michael Sedlak, and P. A. van der Meulen. 35p. Project No. 5-(7-7340). Contract AF33(616)2057.

The preparation of benzeneboronic acid, tri-n-butylborane, butylboron dichloride, and phenylboron dichloride as intermediates for our new borazole synthesis with alkylboron dihalides and amines is described. A new catalytic recirculating apparatus for preparing phenylboron dichloride from benzene and boron trichloride by Pace's method is described. (auth)

7268 NYO-6613

Yale Univ., New Haven.

DIFFUSION COEFFICIENTS OF ELECTROLYTES IN DILUTE AQUEOUS SOLUTION. Herbert S. Harned. Jan. 20, 1955. 18p. Contract AT(30-1)-1375.

A critical survey of the diffusion coefficients of the alkali metal chlorides in dilute aqueous solutions at 25° confirms a previous conclusion that at concentrations below 0.01 normal, the equation of Onsager and Fuoss is valid within the error of experiment. The diffusion coefficients of calcium and strontium chlorides are contrasted

and the apparent anomalous behavior of calcium chloride is discussed. (auth)

7269 NYO-6620

Carnegie Inst. of Tech., Pittsburgh. Metals Research Lab. ELECTROCHEMICAL STUDIES OF NON-AQUEOUS MELTS. Quarterly Progress Report for Period Ending June 1, 1955. R. F. Mehl and G. Derge. 27p. Contract AT(30-1)-1024.

A determination of the conductivity of molten Cu_2S as a function of sulfur activity was made. Results show that the conductivity increases with sulfur content on the sulfur-rich side but remains constant for copper-rich melts. This increase of conductivity on the sulfur-rich side seems to indicate that molten Cu_2S behaves as a solid p-type semiconductor. Addition of TiS_2 to Cu_2S has the effect of lowering the conductivity considerably. The temperature coefficient of conductivity is positive and would thus indicate that there are ionic species in the melt. Results obtained in the self-diffusion of Fe in molten Fe-C systems show that, at constant temperature, diffusion of Fe is faster in a melt containing a higher percentage of carbon. (auth)

7270 RMO-2018

International Minerals and Chemical Corp., Chicago. URANIUM PRODUCTION—PROCESS DESIGNS FOR LEACHED ZONE PLANTS. VOLUME VII. AMMONIA, NITRIC ACID AND AMMONIUM NITRATE PLANTS. D. F. Clements, W. B. Williams, R. F. McCullough, and E. E. Wrege, Sept. 1953. Decl. Apr. 13, 1955. 39p. Contract AT(49-1)-545. (IMCC-2038)

The estimated investment and operating costs for the production of anhydrous ammonia, nitric acid and ammonium nitrate in various plant capacities are presented. Included are the bases for plant designs, cost estimates, economic studies, raw materials, utilities and a process description. The basis for all investment and operating costs pertaining to the production of the nitrogen-containing compounds which serve as raw materials in the processes described in the other reports of this series is presented. Processes selected for cost estimation for the production of ammonia, nitric acid and ammonium nitrate include recent improvements. A brief description of these processes is presented. (auth)

7271 RMO-2031

International Minerals and Chemical Corp., Chicago. LEACHED ZONE—DISSOLUTION OF VALUES USING HEAT TREATED FEEDS. Harold W. Long, Jr., John H. Gross, Robert F. McCullough, and Roger Bart. Sept. 24, 1954. Decl. Apr. 13, 1955. 80p. Contract AT(49-1)-545. (IMCC-2166)

Digestion characteristics for three samples of minus 200 mesh leached zone have been studied extensively. Samples were selected to contain high proportions of wavellite, pseudowavellite, and kaolinite, and recovery of values from each in digestion with sulfuric acid was determined over a wide range of conditions. Digestions with ammonium bisulfate and nitric acid also were studied. Rates of all three feeds in sulfuric acid are of normal form. For uncalcined wavellite and pseudowavellite, recoveries level off at reasonably high values after two to four hours digestion at 80°C . Solution of aluminum from uncalcined kaolin is much slower. Calcination of all three feeds increases solution rates so that reaction is essentially complete after one half to one hours digestion with sulfuric acid at 80°C . Kaolin requires calcination at temperatures

between 500 and 700°C to give high recoveries in short-time digestions, however, the values contained in kaolin are insufficient to make this consideration important. The phosphatic feeds show broad maxima in recoveries after calcination at 300 to 400°C and 700°C . All three feeds show the same relative behavior with nitric acid and ammonium bisulfate as with sulfuric acid. Higher solution rates are found with nitric acid, and lower with ammonium bisulfate. Neither of these two reagents shows any other effect leading to selective dissolution of uranium. Sulfuric acid consumption per unit uranium dissolved is not greatly affected by feed calcination temperature with the phosphate minerals. Minimum sulfuric acid consumption per unit uranium dissolved is reached using between 20 and 40% of the stoichiometric acid requirement for wavellite and pseudo-wavellite, with or without calcination, and has a value near one ton of H_2SO_4 per pound of U_3O_8 dissolved for the feeds studied. (auth)

7272 UCRL-3068

California. Univ., Berkeley. Radiation Lab. CHEMISTRY DIVISION QUARTERLY REPORT [FOR] MARCH, APRIL, MAY 1955. July 6, 1955. 57p. Contract W-7405-eng-48.

Bio-organic Chemistry. Photosynthetic kinetic studies were continued on algae. An attempt was made to isolate tetrose phosphate from Scenedesmus photosynthetic extracts. The photosynthetic cycle operating in Euglena in organic medium was determined. The effect of x irradiation upon the incorporation of adenine into rats was investigated. The relative toxicity of the thioctic acids in rats was determined. Respiratory patterns of rats injected with labeled compounds were studied. The effects of radiation on the decomposition of thioctic acid, calcium glycolates, and choline analogs were investigated. Several O^{17} -enriched organic compounds were prepared. Solubilities, refractive indices, and specific gravities are tabulated for the 1-propanol-toluene-water system. Nuclear Chemistry. Additional spectral data are presented for Cm^{241} , Cf^{249} , Cm^{242} , Pu^{238} , and Th^{230} . The half life of Am^{243} was determined as 7.6×10^3 yr. The Po^{206} alpha energy was found to be 5.218 Mev. The results of bombarding Al with 5.7-bev protons are tabulated. Deuteron cross sections for Pu^{239} and alpha cross sections for U^{233} , U^{235} , and U^{238} are reported. The gamma spectra and half lives of the isotopes Lu^{170} , Lu^{171} , and Lu^{172} were studied. The gamma spectra of Bi^{204} and Bi^{203} are reported. The decay schemes of Pb^{204} , Pb^{203} and Bi^{207} were diagrammed. No delayed transition was found following the alpha decay of Cf^{249} to Cm^{245} . Np^{237} and Th^{231} were investigated for possible metastable states. The crystal structures of Cr_5Si_3 and 3-hydrazino-5-thiol-1,2,4-triazole were determined. General Chemistry. The reduction of H_2CrO_4 by H_2O_2 was studied. (For preceding period see UCRL-2932.) (C.W.H.)

7273 UCRL-4519

California. Univ., Livermore. Radiation Lab. SOME PHYSICAL PROPERTIES OF THE HYDRIDES. Robert E. Elson, Howard C. Hornig, William L. Jolly, John W. Kury, William J. Ramsey, and Allan Zalkin. June 7, 1955. 95p. Contract W-7405-eng-48.

The physical properties of all the hydrides for which data are known are tabulated. The properties listed include the simple thermodynamic functions of formation, the thermodynamic functions and temperatures for various processes (e.g., fusion, vaporization), dissociation or

vapor pressure data, densities, and crystallographic data. (auth)

7274 WADC-TR-54-137

Battelle Memorial Inst., Columbus, Ohio.

THE FAST AND SLOW REACTIONS OF HYDROGEN-OXYGEN-PROPANE MIXTURES. Arthur Levy. Feb. 1954. 23p. Project title: RAMJET TECHNOLOGY. Task 70334. Contract AF33(038)-12656.

The effect of propane, C_3H_8 , on the fast and slow reactions of H_2 and O_2 was investigated. An "induced explosion" reaction was observed which is explained in terms of consecutive reactions, whereby C_3H_8 is oxidized rapidly in the first reaction, and H_2 and O_2 combine in the second reaction. The propane effect was compared to the methane effect. (C.W.H.)

7275 WIN-20

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

INITIAL TESTS OF LA SAL SHAFT ORE IN THE ALKALINE LEACH PILOT PLANT. J. Q. Jones, D. O. Skiles, and Guy Winslow. July 29, 1955. 26p. Contract AT(49-6)-924.

By the use of an extended leaching time of 112 hr and a temperature of $172^\circ F$, a dissolution of 99.1% of the uranium from La Sal ore was obtained. Three-stage filtration of the pulp gave a soluble loss of 1.5% and a filter rate of 276 lbs./ft² per 24 hr, using 0.05 lb of Separan-2610 per ton. The best filter rate obtained was in excess of 600 lbs./ft² per 24 hr. Overall recovery of uranium in the "yellow cake" was 95.7% for the entire run. The product assayed 75.5% on a dry basis, and slightly better than 80% U_3O_8 if washed on the filter before drying. Indicated reagent consumptions are 20 lb. of caustic soda and 0.1 lb. of Separan per ton of ore. Fuel oil requirements for pulp heating were 21.3 gal. per ton of ore. (auth)

7276 AEC-tr-2237

FLUORITE PHASE IN THE $ThO_2-Y_2O_3$ SYSTEM. ITS LATTICE DEFECT, ELECTROLYTIC CONDUCTIVITY AND IRREGULAR LATTICE DISTORTION. F. Hund and R. Mezger. Translated from *Z. physik. Chem.* 201, 268-77 (1952). 8p. Available from Associated Technical Services (Trans. 80G6G), East Orange, N. J.

An abstract of this paper appears in *Nuclear Science Abstracts* as NSA 7-2507.

7277 AEC-tr-2238

CERIUM-URANIUM BLUE AND MIXED CRYSTALS IN THE SYSTEM $CeO_2-UO_2-U_3O_8$. Walter Rüdorff and Gerhard Valet. Translated from *Z. anorg. u. allgem. Chem.* 271, 257-72(1953). 14p. Available from Associated Technical Services (Trans. 73G6G), East Orange, N. J.

An abstract of this paper appears in *Nuclear Science Abstracts* as NSA 7-3408.

7278 AEC-tr-2247

ANOMALOUS MIXED CRYSTALS IN THE SYSTEM CERIUM DIOXIDE-URANIUM OXIDE. F. Hund, R. Wagner, and U. Peetz. Translated from *Z. Elektrochem.* 56, 61-5(1952). 8p. Available from Associated Technical Services (Trans. 74G6G), East Orange, N. J.

An abstract of this paper appears in *Nuclear Science Abstracts* as NSA 6-5572.

7279 AEC-tr-2250

DECOMPOSITION POTENTIALS OF THE SYSTEMS $NaF-ZrF_4$ AND $NaF-ZrF_4-ZrO_2$. Yu. (Ju.) K. Delimarski,

A. A. Kolotii, and V. A. Lapa. Translated from *Ukrain. Khim. Zhur.* 19, 372-6(1953). 9p.

The decomposition potentials for the systems ZrF_4-NaF and $ZrF_4-NaF-ZrO_2$ were measured with differing ratios of components and at varying temperatures. The decomposition potential of sodium fluorozirconate decreases as the temperature increases, and increases as the NaF concentration increases. Zirconium is liberated at the cathode during the electrolysis of the two systems. (C.W.H.)

7280 AERE-Lib/Trans-539

INVESTIGATIONS ON SELF-DIFFUSION AND CHEMICAL CHANGE IN SOLID SUBSTANCES USING EMANATION AS THE INDICATOR. Robert Jagitsch. Translated by F. Hudswell from *Trans. Chalmers Univ. Technol.*, Gothenburg Sweden 5, No. 11, 3-47(1942). 35p.

The possibilities of using the emanation method are discussed. It is shown that the migration of the atoms of emanation in solid substances is coupled with the processes of motion of the lattice units and that the emanation method therefore permits of the determination of the heats of separation of ions in the lattice; this possibility is of particular interest in the elucidation of the migration of ions in electronic conductors. Reversible and complete kinetic equilibria, which up to the present could not be observed by any other methods, have been determined in solid solution. The velocity of a chemical reaction in solid substances can, in certain circumstances, be determined quantitatively from the change in the emanating power. (auth)

7281 TT-547

LOW TEMPERATURE RESEARCH. VII. THE MOLAR HEATS OF THE ALKALI HALIDES LiF , $NaCl$, KCl , KBr , $RbBr$, and RbI BETWEEN 10° AND $273^\circ K$. (Ergebnisse der Tieftemperaturforschung. VII. Die Molwärmen der Alkalihalogenide LiF , $NaCl$, KCl , KBr , KJ , $RbBr$ und RbJ von 10° bis 273° abs.). Klaus Clusius, Jochen Goldmann, and Albert Perlick. Translated by H. A. G. Nathan from *Z. Naturforsch.* 4a, 424-32(1949). 22p.

In order to test the region in which the Debye continuum model holds, the molar heats of LiF , $NaCl$, KCl , KBr , KI , $RbBr$, and RbI , in the form of fused rod-shaped crystals were measured in a vacuum calorimeter. For none of these salts was a constant Debye characteristic temperature H_D obtained. (auth)

7282

THERMODYNAMIC PROPERTIES OF THE ALKALI METALS. William H. Evans, Rosemary Jacobson, Thomas R. Munson, and Donald D. Wagman. *J. Research Natl. Bur. Standards* 55, 83-96(1955) Aug.

The available data on the thermodynamic properties of the elements lithium, sodium, potassium, rubidium, and cesium have been analyzed, and selected values of these properties are presented in tabular form. The tables include values of the free-energy function, $(F^\circ - H_0^\circ)/T$; heat-content function, $(H^\circ - H_0^\circ)/T$; entropy, S° ; heat content, $(H^\circ - H_0^\circ)$; heat capacity, C_p° ; heat formation, ΔH_f° ; free energy of formation, ΔF_f° ; and logarithm of the equilibrium constant of formation, $\log K_f$, for the solid, the liquid, and the monatomic and diatomic gases as a function of temperature from $0^\circ K$ to high temperatures. (auth)

7283

SOIL CHEMISTRY AND THE UPTAKE OF FISSION PRODUCTS. C. B. Amphlett (Atomic Energy Research

Establishment, Harwell, Berks, England). Research 8, 35-40(1955) Sept.

The likely fate of radioactive contamination from an atomic bomb explosion or nuclear reactor accident is traced according to the nature of the ground contaminated. A discussion of possible treatment of contaminated land is included. (D.E.B.)

7284
PHYSICO-CHEMICAL INVESTIGATION OF LITHIUM PEROXIDE. T. V. Rode, T. A. Dobrynina, and G. A. Gol'der (Kurnakov Inst. of General and Inorganic Chemistry). Izvest. Akad. Nauk. S.S.S.R. Otdel. Khim. Nauk, No. 4, 611-1(1955) July-Aug. (In Russian)

7285
CERTAIN FORMULAS FOR THE IONIZATION POTENTIALS OF ATOMIC IONS. P. V. Nemtsev. Zhur. Fiz. Khim. 29, 236-9(1955) July. (In Russian)

7286
VIBRATIONAL SPECTRA AND STRUCTURE OF DIBORANE. L. M. Sverdlov and I. N. Zaitseva (Saratovskii State Univ.). Zhur. Fiz. Khim. 29, 1240-7(1955) July. (In Russian)

7287
SODIUM ORTHONIOBATE. A. V. Lapitskii and G. V. Zavodnaya (Moscow State Univ.). Zhur. Obshchei Khim. 25, 1263-5(1955) July. (In Russian)

ANALYTICAL PROCEDURES

7288 BMI-1033
Battelle Memorial Inst., Columbus, Ohio.
ANALYSIS FOR OXYGEN AND NITROGEN IN URANIUM. Cecil B. Griffith, William M. Albrecht, and Manley W. Mallett. Aug. 23, 1955. 9p. Contract W-7405-eng-92.

A systematic study was made to determine the reliabilities of the vacuum-fusion and Kjeldahl methods for the determination of O₂ and N₂ in U. It was found that the vacuum-fusion method can be applied to the analysis for O₂ in U when the O₂ occurs in solution or as UO or UO₂, but the method cannot be used for the analysis for N₂. However, it was found that reliable and consistent analyses for N₂ in U can be obtained by the Kjeldahl method. (auth)

7289 BNL-2041
Brookhaven National Lab., Upton, N. Y.
POLAROGRAPHIC DETERMINATION OF ZIRCONIUM. Arno H. A. Heyn. [1954?] 3p. Contract [AT-30-2-GEN-16].

A new method is described for the polarographic determination of Zr in aqueous solution. The determination is carried out in fluoride (~0.1 M F⁻) and at pH = 7.0, to minimize the interference due to hydrogen. (C.W.H.)

7290 BNL-2130
Brookhaven National Lab., Upton, N. Y. and Syracuse Univ., N. Y.
SPECTROPHOTOMETRIC TITRATION OF MILLIGRAM QUANTITIES OF BARIUM. Keith Rowley, Raymond W. Stoenner, and Louis Gordon. [1954]. 8p. Contracts [AT-30-2-GEN-16] and AT(30-1)-1213].

A method is described for the determination of 0.1 to 5 mg of Ba which utilizes a spectrophotometric detection of the end-point in the complexometric detection of the end-point in the complexometric titration with Versene. (auth)

7291 LA-1920
Los Alamos Scientific Lab., N. Mex.
AN EXTRACTION METHOD FOR THE DETERMINATION

OF URANIUM ALPHA ACTIVITY IN URINE. Evan E. Campbell, Billye Marie Head, and Morris F. Milligan. June 1955. 24p. Contract W-7405-eng-36.

Uranium is extracted from nitric-acid-ashed urine by di-n-butyl orthophosphoric acid (0.38N in CCl₄). The CCl₄ extract is evaporated, fused, and alpha assayed. The extraction efficiency depends on the acid concentration of the dissolved urine salts. (auth)

7292 LRL-117
California Research and Development Co. Livermore Research Lab., Livermore, Calif.
POLAROGRAPHY IN MOLTEN AMMONIUM FORMATE. E. L. Colichman. Apr. 1954. Decl. Jan. 17, 1955. 19p. Contract AT(11-1)-74.

A wide variety of inorganic compounds have been investigated polarographically in molten ammonium formate at 125°C. Among the compounds studied were materials such as uranium, thorium and plutonium, as well as typical fission products such as zirconium and the rare earths. Possible applications to qualitative and quantitative analyses of both water-soluble and water-insoluble inorganic compounds are suggested by the polarographic results obtained herein. Results obtained indicate the relative degrees of electropositivity of the various ionic species in the molten ammonium formate system under the conditions prevailing in this investigation. (auth)

7293 NP-5762
Canada. Dept. of Mines and Technical Surveys. Mines Branch.

A MILL PROCEDURE FOR DETERMINING URANIUM IN LOW-GRADE ACID SOLUTIONS. R. J. Guest and J. B. Zimmerman. June 6, 1955. 12p. (TR-129/55).

A rapid method is described for the determination of uranium in low-grade acid solutions. Uranium is extracted by ethyl acetate from a nitric acid solution heavily salted with aluminum nitrate, final determination of uranium being carried out colorimetrically by means of the sodium hydroxide-hydrogen peroxide method or by the thiocyanate method. Solutions containing as little as 0.005 g/l U₃O₈ can be assayed for uranium by this procedure. The procedure is well suited for application as a mill procedure for uranium. (auth)

7294 NP-5763
Canada. Dept. of Mines and Technical Surveys. Mines Branch.

THE DETERMINATION OF SMALL AMOUNTS OF URANIUM IN ORES AND SOLUTIONS USING TRIBUTYL PHOSPHATE AND ETHYL ACETATE. R. J. Guest. May 30, 1955. 22p. (TR-128/55)

A method is described for the determination of amounts of uranium in ores and solutions in the range 0.005 to 1.0% or g/l U₃O₈. Uranium is separated from contaminants by means of an ethyl acetate extraction from a nitric acid solution heavily salted with aluminum nitrate. If the uranium content of the sample is very low a preliminary extraction of uranium is carried out by means of a solution of tributyl phosphate in N-hexane from a strong nitric acid solution. Final determination of uranium is carried out colorimetrically either by the sodium hydroxide-hydrogen peroxide method or by the thiocyanate method. The method should be of value for laboratories where the volume of work does not justify the expense of installing equipment for fluorimetric analysis. (auth)

7295 RDB(C)/TN-138

Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
 THE DETERMINATION OF SILICON IN VANADIUM AND
 VANADIUM OXIDES. C. O. Granger. Aug. 15, 1955. 18p.
 (ARDC.P/139)

Development of a new procedure for the determination of silicon in vanadium and vanadium oxides is described. It consists in the removal of vanadium(IV) from aqueous solution as a complex with thiocyanic acid by means of a single extraction with methyl ethyl ketone, followed by the absorptiometric determination of silicate as reduced silico-molybdic acid. Some unsuccessful attempts to apply other procedures are briefly described. (auth)

7296 UCRL-2619

California. Univ., Berkeley. Radiation Lab.
 FACTORS INFLUENCING AMMONIA DECOMPOSITION IN
 THE KJELDAHL METHOD WITH SEALED TUBE DIGES-
 TION. LeRoy G. Green, Charles W. Koch, Benjamin W.
 Grunbaum, and Paul L. Kirk. June 1954. 22p. Contract
 W-7405-eng-48.

The investigation of conditions for the sealed tube Kjeldahl digestion demonstrated that ammonia loss in the digestion is due to oxidation of ammonia to nitrogen gas. It was shown that excellent agreement existed between the results on the milligram and microgram scales. Also it was found that oxidation of ammonia by sulfur trioxide or by oxygen (alone) occurs over the same temperature range. The difference in rate of the oxidation probably is due to differences in the partial pressure of the oxidizing species. The data indicate that half-hour digestions are more than adequate for the destruction of the organic portion of a substance with compounds as refractory as tryptophane and that prolonged digestion can result in the oxidation of appreciable quantities of ammonia. The addition of water to the digestion mixture had a pronounced effect in lowering the rate of oxidation of ammonia. Consequently, digestion temperatures greater than 470°C may be safely used when small amounts of water are added without seriously altering the rate of destruction of the organic portion of the molecule and without increasing the ammonia loss. (auth)

7297 Y-893

Carbide and Carbon Chemicals Co. Y-12 Plant, Oak Ridge,
 Tenn.

DETERMINATION OF SILICON IN URANIUM METAL.
 W. B. Wright, Jr. May 15, 1952. Decl. Oct. 18, 1954.
 13p. Contract W-7405-eng-26.

Utilization of the silicomolybdic acid color for the determination of Si in U is described. The determination requires separation of the U and Si to prevent interference from absorption by uranyl ions. Phosphorus which interferes with the colorimetric determination, generally is not present in sufficient quantity to handicap the method. (L.T.W.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE**7298 AEC-TR-2229**

ANOMALOUS MIXED CRYSTALS IN THE SYSTEM ZrO_2 -
 Y_2O_3 . THE CRYSTAL STRUCTURE OF NERNST RODS.
 F. Hund. Translated from Z. Elektrochem. 55, 363-6(1951).
 6p. Available from Associated Technical Services (Trans.
 82G6G), East Orange, N. J.

It was shown that in the ZrO_2 - Y_2O_3 system there occurs a

fairly extensive fluorspar phase in addition to the two pure phases. These anomalous mixed crystals possess a lattice defect of the subtraction-substitution type. Zirconium and Y are distributed statistically over the cation lattice, but there are vacancies in the anion lattice. The conductivity of the Nernst rods is related to the crystal structure. (auth)

7299 AERE-Lib/Trans-535

THE DISPERSE STRUCTURE OF SOLID REAL SYSTEMS
 AND ITS THERMODYNAMIC FOUNDATION. D. Balarew.
 Translated by F. Hudswell from *Kolloid-Z.* 88, 161-71(1931)
 16p.

The theory of the structure of crystal systems as conglomerates was reinvestigated. The observation of the change in behavior of certain crystal systems heated to different levels has shown that the transformations result from the treatment are generally reversible. (C.W.H.)

7300 TT-541

LUMINESCENCE AND ADSORPTION OF CRYSTALS OF
 POLYCYCLIC HYDROCARBONS. (Syechenie i Tsvet
 Kristallov Politsiklicheskikh Uglevodorodov). I. V.
 Obreimov and A. F. Prikhot'ko. Translated by G. Belkov
 from *Akad. Nauk S.S.S.R., Pamyati S. I. Vavilova*, 197-
 209(1952). 23p.

The spectra in luminescence and absorption and the refractive indices were investigated for a series of linear condensed hydrocarbons (benzene, naphthalene, anthracene and naphthacene) at low temperatures. The results of this investigation are discussed in detail. From a comparison of the spectra of vapors and crystals, the spectral bands of a crystal can be classified. All the crystals observed were brightly luminescent. (B.J.H.)

7301

LITHIUM METANIOBATE AND METATANTALATE. A. V.
 Lapitskii and Yu. P. Simanov (Moscow State Univ.). *Zhur.
 Fiz. Khim.* 29, 1201-3(1955) July. (In Russian)

X-ray diffraction and crystallographic data are given for $LiNbO_3$ and $LiTaO_3$. (G.Y.)

DEUTERIUM AND DEUTERIUM COMPOUNDS**7302**

PRODUCTION OF HEAVY WATER. NATIONAL NUCLEAR
 ENERGY SERIES, DIVISION III, VOLUME 4F. George M.
 Murphy, Harold C. Urey, and Isidor Kirshenbaum, eds.
 New York, McGraw-Hill Book Co., Inc., 1955. 394p. \$5.2

The commercial production of heavy water by the following methods is described: catalytic exchange-electrolytic process, the distillation of water, and the distillation of hydrogen. Laboratory and pilot-plant studies of various separation processes are included. (C.W.H.)

FLUORINE AND FLUORINE COMPOUNDS**7303**

THE CHEMISTRY OF PERFLUORO ETHERS. I. SUB-
 STITUTION OF α -FLUORINE BY CHLORINE: THE α, α, α' -
 TRICHLORO PERFLUORO ETHERS. George Van Dyke Thomsen
 (Minnesota Mining and Manufacturing Co., St. Paul). *J. Am.
 Chem. Soc.* 77, 4837-40(1955) Sept. 20.

The first chemical reaction of perfluoro ethers is reported. Selective substitution of the α -fluorine atoms by chlorine has been achieved, using aluminum chloride as the

exchange agent. Perfluorotetrahydrofurans and tetrahydro-pyrans bearing a single perfluoroalkyl substitution in the α position are converted to their α, α, α' -trichloro analogs in good yield. Physical properties are reported for the compounds prepared. Synthesis of a perhalo lactone is described. (auth)

GRAPHITE

7304

LOW TEMPERATURE HEAT CAPACITY OF CEYLON GRAPHITE. Warren DeSorbo (General Electric Research Lab., Schenectady, N. Y.). J. Am. Chem. Soc. **77**, 4713-15 (1955) Sept. 20.

Low-temperature specific heat data are presented in the temperature region 17 to 300°K for a Ceylon natural graphite. The data and the thermodynamic functions derived therefrom are compared with those previously reported for a graphite sample having a smaller crystallite size. (auth)

7305

CARBON AND GRAPHITE. W. M. Gaylord (National Carbon Co., Cleveland). Ind. Eng. Chem. **47**, 1953-5(1955) Sept. (cf. NSA 7-6403)

The physical properties of graphite are outlined; the oxidation resistance of graphite was investigated. Several industrial applications of graphite are mentioned, including process equipment development. (C.W.H.)

LABORATORIES AND EQUIPMENT

7306 TID-5280

FOURTH ANNUAL SYMPOSIUM ON HOT LABORATORIES AND EQUIPMENT, HELD IN WASHINGTON, D. C., SEPTEMBER 29 AND 30, 1955. Sept. 1955. 389p.

Forty papers are presented on recent innovations in equipment for radiation laboratories and in laboratory facilities design. (For papers of the preceding conference, see Nucleonics **12**, No. 11, 36-100(1954) Nov.) (C.W.H.)

RADIATION CHEMISTRY

7307

SENSITIZATION AND SUPPRESSION OF OXIDATION-REDUCTION REACTIONS BY RADIOLYSIS. M. A.

Proskurnin, V. D. Orekhov, and E. V. Barelko. Uspekhi Khim. **24**, 584-97(1955). (In Russian)

A review. 26 references. (G.Y.)

RADIATION EFFECTS

7308

NUCLEAR RADIATIONS: THEIR EFFECTS UPON ORGANIC MATERIALS. Samuel S. Jones (Knolls Atomic Power Lab., Schenectady, N. Y.). Can. Chem. Processing **39**, 36-46(1955) Apr.

With the emphasis on chemical reactions, this paper discusses in some detail how the physical and chemical properties of organic materials may be changed by the absorption of radiation. Many such materials are discolored by irradiation, and many show changes in various electrical properties such as the electrical conductivity. Regarding chemical reactivity, many organic materials show either one

or the other of two tendencies to a greater degree. They may be broken down by radiation to form simpler products of lower molecular weights than the parent material, or they may be converted to materials of higher molecular weight. This last process is called polymerization or crosslinking, depending upon the nature of the parent material, while the first process is known as degradation. While one or the other of these two processes predominates in many organic materials, the efficiencies of the processes and the nature and amounts of other radiation-produced substances will be influenced by specific chemical effects. These specific chemical effects include such factors as the stabilizing effect of aromatic rings, specific forms of behavior of certain functional groups, and environmental effects such as temperature, presence of oxygen and water. With regard to future uses for nuclear radiations, it does not appear that radiation processing can be expected to compete with conventional processes where it does not offer substantial advantages. It is expected to be most useful where it can be employed in smaller amounts to accomplish unique or unusual results. (auth)

7309

RADICAL PRODUCTION IN THE RADIOLYSIS OF THE HYDROCARBONS. Edward N. Weber, Paul F. Forsyth, and Robert H. Schuler (Canisius Coll., Buffalo, N. Y.). Radiation Research **3**, 68-76(1955) Sept.

SEPARATION PROCEDURES

7310 Y-884

Carbide and Carbon Chemicals Co. Y-12 Plant, Oak Ridge, Tenn.

COMPARISON OF TRIBUTYL PHOSPHATE AND DIBUTOXYTETRAETHYLENEGLYCOL AS EXTRACTANTS OF URANIUM. W. B. Wright, Jr. May 7, 1952. Decl. Oct. 18, 1954. 20p. Contract W-7405-eng-26.

A routine extraction procedure to recover uranium with tributyl phosphate from production samples was developed and compared with the standard pentaether procedure for accuracy and precision, speed of analysis, and purity of extraction product. The TBP method was found to be faster and to yield a purer product, and the precision and accuracy of both methods were of the same order of magnitude; an accurate and significant cost comparison was not possible. (auth)

7311

STUDIES ON ION EXCHANGE RESINS. XIV. TITRATION, CAPACITY AND SWELLING OF METHACRYLIC ACID RESINS. Harry P. Gregor, Mary Jane Hamilton, Jane Becher, and Fabian Bernstein (Polytechnic Inst. of Brooklyn). J. Phys. Chem. **59**, 874-81(1955) Sept.

Titration curves of cross-linked polymethacrylic acid polymers are typical of those of polyacids. The polyacids are apparently weaker than their linear counterparts measured at the same salt concentration, reflecting the high Donnan concentration in the gel. When quaternary ammonium bases are used in place of alkali metal bases, there is a pronounced decrease in the average dissociation constant of the polyacids, which is presumed due to an increased chain potential resulting from the greater distance of closest approach with large gegenions. The swelling of the resins was larger with large gegenions, again indicative of a higher chain potential. Lithium and, to a lesser extent, sodium

ions associate with the polyacid, as shown by swelling measurements. (auth)

7312

THE FINAL EFFECTS OF EXTRACTION IN THE URANYL NITRATE-DIETHYL ETHER-WATER SYSTEM. I. CONTINUOUS WATER PHASE. A. Perez Luina, L. Gutierrez Jodra, and A. Rius Miro. *Anales real. soc. espan. fis. y quim. (Madrid) Ser. B* **51**, 487-96(1955) July-Aug. (In Spanish)

The solute transfer taking place in a spray column has been studied for the system uranyl nitrate-diethylether-water. In order to determine the distribution of concentration of the continuous phase, the technique of internal sampling has been used. The experiments have been carried out in a laboratory column of glass, 102 cm long and 4.7 cm diameter using the ether phase as dispersed and a direction of extraction from ether to water. The rates of flow of both phases and the height of the column have been considered as variables. In the runs a marked end effect has been found in the entrance of the continuous phase and also in the entrance of the dispersed phase, the latter being found only in some former. It seems as if the effect in the continuous phase would be due to turbulence induced by the drops of the dispersed phase. The effect in the dispersed phase depends upon the rates of flow of both phases and is only found for high flows of the continuous phase and low flows dispersed phase. (auth)

7313

THE FINAL EFFECTS OF EXTRACTION IN THE URANYL NITRATE-DIETHYL ETHER-WATER SYSTEM. II. CONTINUOUS ETHER PHASE. A. Perez Luina, L. Gutierrez Jodra, and A. Rius Miro. *Anales real. soc. espan. fis. y quim. (Madrid) Ser. B* **51**, 497-505(1955) July-Aug. (In Spanish)

The solute transfer of uranyl nitrate from diethylether to water has been studied in a spray column using water as dispersed phase and a direction of extraction from ether to water. The column is 102 cm long and has a diameter of 4.7 cm. The entrances of the phases are 77 cm apart. The rates of flow of both phases have been used as variables and the concentration of the continuous phase has been determined at different heights. The curves of logarithm of concentration of the continuous phase vs. distance to interphase show the presence of a drop of concentration in the entrance of the continuous phase. This depends on the rates of flow of the phases. No effect in the entrance of the dispersed phase has been found. (auth)

SYNTHESES

7314 NBS-4084

National Bureau of Standards, Washington, D. C.
IMPROVED SYNTHESIS OF SODIUM D-GLUCURONATE-6-C¹⁴ AND OF D-GLUCOSE-6-C¹⁴. R. Schaffer and H. S. Isbell. May 29, 1955. 21p.

A process is reported for the synthesis of barium 1,2-O-isopropylidene-D-glucuronate-6-C¹⁴ in 55% yield from 1,2-O-isopropylidene-D-xylo-dialdopentofuranose and sodium cyanide-C¹⁴. The salt was converted to sodium D-glucuronate-6-C¹⁴ in 92% radiochemical yield and to D-glucose-6-C¹⁴ in 84% yield. The over-all radiochemical yield of D-glucose-6-C¹⁴ based on the sodium cyanide-C¹⁴ used was 46% in comparison with prior yields of approximately 15%. Crystalline 1,2-O-isopropylidene-D-xylo-

dialdopentofuranose and lithium 1,2-O-isopropylidene-D-glucuronate are new compounds. (auth)

7315

NEW METHOD OF SYNTHESIS OF C¹⁴-LABELED p-AMINOBENZOIC ACID AND PRODUCTION OF C¹⁴-LABELED ANESTHETICS ANESTHESIN, NOVOCAIN, AND COCAINE. Yu. V. Markova, L. N. Zenkova, and M. N. Shchukina (Ordzhonikidze All-Union Chemico-Pharmaceutical Research Inst.). *Zhur. Obshchei Khim.* **25**, 1383-7(1955) July. (In Russian)

URANIUM AND URANIUM COMPOUNDS

7316 A-569

Columbia Univ., New York. Div. of War Research.
MANUAL FOR THE CONVERSION OF SMALL SAMPLES OF URANIUM SALTS TO URANIUM HEXAFLUORIDE FOR ISOTOPIC ANALYSIS ON THE MASS SPECTROMETER. B. Weinstock. Mar. 15, 1943. Decl. July 26, 1955. 19p. Contract OEMsr 412. (2R-95)

Methods are presented for the purification of uranium salt samples and for the preparation of U₃O₈ from these samples. The apparatus and procedures used for the conversion of U₃O₈ to UF₆ are described. The effect of impurities on the mass spectrographic analysis of UF₆ is discussed. (C.W.H.)

7317 A-1262

Columbia Univ., New York. Div. of War Research.
THE REACTION OF HYDROGEN AND OXYGEN WITH URANIUM OXIDES IN WATER SUSPENSION. D. M. Gillies. Apr. 17, 1944. Decl. July 29, 1955. 19p. Contract W-7405-Eng-50. (100K-R-632)

The oxidation and reduction of U oxides in water suspension have been investigated. It has been found that below 250°C, the rate of reaction of U⁴⁺ with O₂ is greater than the rate of reduction of U⁶⁺ with H₂. The walls of the containing vessel appear to exert a considerable influence on the course of the reactions; the particle size of the oxide was not found to be a rate-controlling factor. (auth)

7318 AEC-tr-2239

CONCERNING ADDITIONAL FLUORITE PHASES IN THE MIXED OXIDES OF RARE EARTHS WITH URANIUM. INVESTIGATION OF THE SYSTEMS: La₂O₃, Nd₂O₃, Sm₂O₃, Yb₂O₃, Sc₂O₃ WITH U₃O₈. F. Hund and U. Peetz. Translated from *Z. anorg. u. allgem. Chem.* **271**, 6-16(1952). 10p. Available from Associated Technical Services (Trans. 77G6G), East Orange, N. J.

In the lanthanum oxide-uranium oxide system, a fluorite phase occurs for 33 to 70 mol % of LaO_{1.5}. Simultaneously, the lattice constant increases from 5.462 to 5.543 kX for the mixed crystal containing 68.0 mol % of LaO_{1.5}. The C-type sesquioxide occurs at the end which is rich in lanthanum oxide. Due to the anomalous formation of mixed crystals, the C-type becomes stable up to 1200°. The fluorite type mixed crystals have an intact cation lattice. In the neodymium oxide-uranium oxide system, anomalous mixed crystals of the fluorite type occur for 25-65 mol % of neodymium oxide. The space lattice constant changes from 5.423 to 5.437 kX along this variation in concentration. When the neodymium concentration is high, the C-type occurs in a stable state up to 1200°. The anomalous fluorite type mixed crystals also have an intact cation lattice. In the system of uranium oxide with samarium oxide, ytterbium oxide, and scandium oxide, fluorite phases have also been observed

and the space lattice constants of 50 mol % mixed crystals have been determined. (auth)

7319 AEC-tr-2240

ANOMALOUS MIXED CRYSTALS IN THE THORIUM OXIDE-URANIUM OXIDE SYSTEM. F. Hund and G. Niessen. Translated from *Z. Elektrochem.* 56, 972-9(1952). 14p. Available from Associated Technical Services (Trans. 78G6G), East Orange, N. J.

Amounts of thorium and uranyl nitrate corresponding to the desired mixed oxide were dissolved, evaporated, and the residues were ignited to oxides in air at 1200° according to defined conditions. An anomalous fluorite phase extended from pure thorium dioxide to 56.5 mol % of uranium oxide. The lattice constant determined according to Straumanis falls at the same time from 5.5840 ± 0.0002 kX for thorium dioxide to 5.4742 ± 0.0008 kX for the mixed crystal which has 56.5 mol % of uranium oxide. A two-phase region is juxtaposed to the latter. It consists of cubic boundary-mixed crystals and U_3O_8 as components. The pycnometric densities were determined at 25° for all specimens of the cubic phase, and densities possible for both defect structures were calculated (also with UO_2 as the uranium component). From 0 up to about 15 mol % of uranium oxide, there exists a perfect cation lattice with probably only tetravalent uranium. From there on, vacancies appear in the cation lattice with partial oxidation of uranium from IV to VI. From about 25 mol % of uranium oxide with its ideal anion lattice and vacancies in the cation positions, a further filling in of cation point positions takes place. An imbedding of oxygen ions into the interstitial positions takes place during the insertion of uranium oxide. The temperature dependence of the electrical resistance was measured on appropriate specimens. The defect structure which was derived from the density considerations can be confirmed from the logarithms of the specific resistance at the same temperature and from the relative values of the activation energy of the electrical conduction phenomenon. The thermal vibration type of lattice disorder of this broad fluorite phase was determined on some specimens according to the absolute [basic] method. It was related to the defect structure, the resistance measurement, and the relative activation energy of the electrical conduction. (auth)

ENGINEERING

7320 WADC-TR-53-83(Pt.2)

Standard Oil Co. Of Indiana, Whiting.

DEVELOPMENT AND EVALUATION OF HIGH TEMPERATURE GREASES. Edward A. Swakon and Cecil G. Brannen. March 1955. 58p. Project title: AVIATION LUBRICANTS. Task title: AIRCRAFT LUBRICATING GREASES. Contract AF 33(038)-23687.

In the work directed toward the development of an aircraft grease suitable for use over the temperature range of -65 to 450°F, emphasis was placed on the development of thickeners for silicone fluid and on the evaluation of greases at high temperatures. Studies were made on silicone greases thickened with substituted ureas and other materials which might be expected to produce thermally stable greases. A new class of non-soap, organic thickening agents, called arylureas, was developed. Greases made with arylureas are extremely heat stable, are easily made in conventional grease equipment, exhibit good rheological

properties, and have out-performed all other greases in the bearing test at 450°F. The lowest temperature at which these greases meet the values given in the requirements is around -40°F. Twenty-six of thirty tests on eleven compositions made with DC-550 Silicone Fluid and arylureas ran between 350 and 1170 hours. On two greases designated MLG-9300 and MLG-9301, ten of fourteen tests ran well over 500 hours. They meet all of the other Air Force requirements except performance in the Navy gear-wear test. Failure in this test is caused by the inherently poor lubrication characteristics of silicone oil and attempts to improve the lubricity by the incorporation of additives have been unsuccessful. Another arylurea grease made with DC-510 Silicone Fluid closely approached the Air Force requirements. This grease is suitable for use at -90°F. Three bearing tests at 450°F averaged 270 hours. Bearing tests on greases comprised of DC-550 Silicone Fluid and the following miscellaneous thickeners—carbon black, copper phthalocyanine, calcium acetate, indigo, and *N*-benzoyl-*p*-amino-benzoic acid—ran between 20 and 427 hours. (auth)

7321

APPLICATION OF ISOTOPIC METHODS IN INVESTIGATION OF CATALYSTS. G. M. Zhabrova (Moscow).

Uspekhi Khim. 24, 598-612(1955). (In Russian)

A review. 76 references. (G.Y.)

HEAT TRANSFER AND FLUID FLOW

7322 AEC-tr-2258

FORMS OF FLOW OF GAS-LIQUID MIXTURES AND THEIR STABILITY LIMITS IN VERTICAL TUBES. B. K. Kozlov. Translated from *Zhur. Tekh. Fiz.* 24, 2285-8(1954). 5p. Available from Associated Technical Services (Trans. 13G7R), East Orange, N. J.

An abstract of this paper appears in *Nuclear Science Abstracts* as NSA 9-2234.

7323 AERE-Lib/Trans-562

THE EFFECT OF THE MATERIAL AND OF THE MECHANICAL TREATMENT OF THE SURFACE ON THE HEAT EXCHANGE IN THE BOILING OF WATER. E. K. Averin. Translated by J. B. Sykes from *Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk*, No. 3, 116-22(1954). 9p.

The critical values of the specific thermal load, temperature excess, and heat exchange coefficient in the boiling of water on steel, Ce, Ni-plated Cu, and Al surfaces are approximately the same. A noticeable effect of the material and roughness of the heat-exchanging surface on the heat exchange coefficient in boiling is observed only for loads up to $\sim 10^5$ kcal/m²h. (auth)

7324 AERE-Lib/Trans-565

INVESTIGATION OF HEAT EXCHANGE IN THE BOILING OF A LIQUID IN PIPES. L. S. Sterman. Translated by J. B. Sykes from *Zhur. Tekh. Fiz.* 24, 2046-53(1954). 8p.

An abstract of this paper appears in *Nuclear Science Abstracts* as NSA 9-1238.

PUMPS

7325 A-3351

Chicago. Univ. Metallurgical Lab.

RYERSON METAL DIFFUSION PUMP—MERCURY TYPE. [Mar. 21, 1945]. Decl. July 16, 1954. 6p.

Photographs, drawings, and physical and operational data for the Ryerson mercury diffusion pump are presented. (D.E.B.)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

7326 NP-5766

American Electro Metal Corp., Yonkers, N. Y.
CEMENTED BORIDES. Summary Progress Report for the Period June 1, 1954 to July 31, 1955. 138p. Contract N6-ONR-256/1.

A new high-temperature material, Borolite IV, was developed, comprising several compositions of the type $\text{Cr}_2\text{B} + \text{Cr}-\text{Mo}$ alloy. The material has outstanding characteristics in heat shock resistance, oxidation resistance and stress-to-rupture strength through 2,000°F. (J.E.D.)

7327 NYO-6450

Massachusetts Inst. of Tech., Cambridge.
THE MEASUREMENT OF THERMAL CONDUCTIVITY OF REFRACTORY MATERIALS. Quarterly Progress Report for the Period Ending July 1, 1955. W. D. Kingery and F. H. Norton. July 1, 1955. 16p. Contract AT(30-1)-960.

Thermal conductivity data are reported over the range from room temperature to 1000°C for compositions in the $\text{MgO}-\text{SiO}_2$ system, for $\text{Gd}_2\text{O}_3-\text{Sm}_2\text{O}_3$ solid solutions, and for single crystals of rutile. Polycrystalline rutile apparently has a lower thermal conductivity than any orientation of the single crystal. Apparatus for measuring infrared absorption spectra over a range of temperatures has been completed. Design of apparatus for measuring thermal conductivity of powders has been completed. (auth)

7328

FACTORS INFLUENCING THE PHYSICAL PROPERTIES OF REFRACTORY CONCRETES. W. C. Hansen and A. F. Livovich (Universal Atlas Cement Co., Gary, Ind.). Am. Ceram. Soc. Bull. **34**, 298-304(1955) Sept. 15.

Data are given for the compressive and flexural strength of 1:4 mix by volume of calcium aluminate cement and crushed high-heat duty fire-clay brick concrete with and without 10% plastic fire clay fired at temperatures in the range of 500 and 2200°F and tested either at the firing temperature or after cooling to room temperature. The data show that strengths determined at test temperatures remained fairly constant over the range of about 500 to 1500°F and then decreased fairly rapidly as the firing temperatures increased to 2200°F; and that strengths determined after cooling to room temperatures decreased with firing temperatures to a minimum at about 1600°F. and then increased. Similar data are given for the concrete molded and cured at temperatures in the range of 50 to 110°F and for concrete heated immediately after molding to temperatures in the range of 80 to 1800°F. The data show that high temperatures during the initial curing of the concrete result in serious loss of strength. Data are also given showing the effect of variations in the maximum size of aggregate and of variation in the proportions of cement to aggregate on compressive strength, unit weight, and linear change of calcium aluminate cement-CFB concrete. These data show that stronger and

denser concretes are obtained with the coarser aggregate and with the mixes of increasing cement contents. The effect of prolonged heating at elevated temperatures for periods up to 5 years on the compressive strength of this type of concrete is also shown. The data demonstrate the relative losses in strength with increasing temperatures for comparable periods of heating. (auth)

7329

CERAMICS. Lane Mitchell (Georgia Inst. of Tech., Atlanta). Ind. Eng. Chem. **47**, 1956-62(1955) Sept.

A review of recent developments in the field of ceramics is presented. Several applications of glass, vitreous enamel, whitewares, and clays are outlined. The physical and electrical properties of a representative ceramic material, boron nitride, are tabulated. (C.W.H.)

7330

SUPER-REFRACTORY MATERIALS. Roger A. Long (Ferrotherm Co., Cleveland). Metal Progr. **68**, No. 3, 123-28, 190, 192(1955) Sept.

A review of the development of three super-refractory materials, TiC plus metal binder, representing the cermets; MoSi_2 , representing the intermetallics; and Mo representing the refractory elements is presented. (auth)

CORROSION

7331 NMI-1137

Nuclear Metals, Inc., Cambridge, Mass.
EFFECT OF HEAT TREATMENT ON THE CORROSION BEHAVIOR OF ZIRCONIUM BINARY ALLOYS OF NICKEL AND IRON. D. S. Kneppel. June 22, 1955. 44p. Contract AT(30-1)-1565.

The effect of heat treatment on the corrosion resistance in 680°F water of zirconium binary alloy of iron and nickel was studied. Slow-cooling zirconium from the beta phase tended to precipitate out the zirconium compounds of iron or nickel resulting in metal of poor corrosion resistance because of preferred attack of these compounds. In addition, it appears that stresses developed when zirconium transforms rapidly from beta to alpha, are also a cause of accelerated attack. Nickel in solid solution is very effective in inhibiting corrosion due to transformation stresses whereas iron is only mildly effective. (auth)

GEOLOGY AND MINERALOGY

7332 BM-IC-7726

Bureau of Mines.
URANIUM MINING ON THE COLORADO PLATEAU. W. L. Dare, R. A. Lindblom, and J. H. Soulé. June 1955. 61p.

A first of a series of publications describing U mining on the Colorado Plateau is presented. The general problems that are encountered in mining ore bodies and factors that effect the selection of development and mining methods are discussed. (J.E.D.)

7333 RME-1052

Division of Raw Materials. Denver Exploration Branch, AEC.
AIRBORNE RECONNAISSANCE IN SOUTHWESTERN ARKANSAS. R. C. Malan and A. L. Nash. Dec. 13, 1954. 14p., 2 illus.

Airborne and ground reconnaissance for uranium was carried out in southwestern Arkansas. Several areas near

Magnet Cove, which contain abnormally radioactive rocks known prior to this survey, were examined and five anomalies, previously unknown, were discovered. Isorad maps of two radiometric anomalies at Wilson's Potash Sulphur Springs were made. Slight radioactivity was detected in five bauxite pits near Bauxite and at Granite Mountain, both south of Little Rock. No abnormal radioactivity was found in the Sevier County lead and zinc district, the Pike County mercury mines, nor accompanying the asphalt pellets in Pike, Howard, and Sevier Counties. (auth)

7334 RME-2014(Pt.I and Suppl.)

Division of Raw Materials. Salt Lake Exploration Branch, AEC.

COPPER-URANIUM DEPOSIT AT THE RIDENOUR MINE, HUALAPAI INDIAN RESERVATION, COCONINO COUNTY, ARIZONA. PART I. Richard D. Miller. SUPPLEMENT: RESULTS OF AN AERIAL RADIOMETRIC EXAMINATION OF THE RIDENOUR MINE DISTRICT, HUALAPAI INDIAN RESERVATION, COCONINO COUNTY, ARIZONA. Earl M. P. Lovejoy. Aug. 1954. 21p.

The Ridenour mine is near the middle of the top sandy member of the Supai formation which is Permian in age. Total thickness of the Supai formation in this area is about 900 ft. The ore minerals occur in veins and brecciated zones which form a semicircular pattern in plan view. Carnotite mineralization forms an enclosing envelope around copper-bearing veins which contain major amounts of malachite, azurite, and chalcocite and minor amounts of chrysocolla, bornite, and chalcopyrite. Gangue minerals are and chiefly pyrite and limonite. A grab sample of the carnotite zone in the hanging wall in one stope assayed 1.8% U_3O_8 , and a select sample from a very thin veinlet in another stope assayed 2.5% U_3O_8 . The dimensions of the uranium-vanadium bearing zone generally have not been exposed by the workings sufficiently to determine the production potential or uranium reserves of the property. Only one anomaly was discovered as a result of airborne work in this area. Since the anomalous radioactivity was less than twice normal background radioactivity, it was not reported as a standard anomaly. It is located in an altered zone in the upper portion of the Hermit shale in which the brick-red portion of the formation has been altered to a light cream or yellow. So far as could be discerned, the alteration is the only visible connection with anomalous radioactivity. Neither faulting, intensive jointing, nor folding is noticeable from the air. (auth)

7335 RMO-555(Rev.)

Division of Raw Materials, AEC.

SOURCES OF GADOLINIUM. Edward K. Judd. May 1950. Revised Nov. 1954. 42p.

A world-wide survey of reported minerals known either to contain Gd or presumed to be a possible source of Gd by reason of the close chemical association with the Tb sub-group of the Yttria earths is presented for the purpose of identifying locations favorable for development in the production of Gd. Brief summary of the occurrences of these minerals is given for the following states and foreign countries; Tex., Colo., Ariz., Va., N. Mex., Canada, Norway, Sweden, Finland, India, Ceylon and Cape Province in the Union of South Africa. The only favorable locality in the United States—Baringer Hill Area, Tex.—from which a prompt and substantial output of gadolinite and associated yttria minerals might be expected unfortunately is located under the waters of Lake Buchanan.

It is concluded that the Scandinavian occurrences offer a potential source for the immediate production of Gd minerals in useful amounts.

7336

MASS SPECTROMETRIC ACCELERATION METHOD OF DETERMINATION OF THE ABSOLUTE AGE OF GEOLOGICAL FORMATIONS BY THE RADIOACTIVE DECAY OF K^{40} INTO A^{40} . Kh. I. Amirkhanov, I. G. Gurvich, and S. S. Sardarov. *Izvest. Akad. Nauk S.S.S.R., Ser. Geol., No. 4*, 80-7(1955) July-Aug. (In Russian)

7337

GEOCHEMISTRY AND MINERALOGY OF A URANIFEROUS SUBBITUMINOUS COAL. Irving A. Breger, Maurice Deul, and Robert Meyrowitz (U. S. Geological Survey, Washington, D. C.). *Econ. Geol.* 50, 610-24(1955) Sept.-Oct.

A sample of subbituminous uraniferous coal from the Red Desert, Sweetwater County, Wyo., has been studied mineralogically. The coal contains gypsum (6%) kaolinite (1%), quartz (0.3%), calcite (trace), and limonite (trace). This suite of minerals and the absence of pyrite show that the coal has been subjected to weathering and oxidation. No uranium minerals have been found; mechanical fractionation has indicated that the uranium is associated with the organic constituents of the coal. The minerals that have been isolated contain 0.0006% uranium, a content that is to be expected for nonuraniferous sedimentary rocks. The organic components of the coal contain approximately 0.002% uranium. On the basis of material-balance calculations, the organic components carry 98% of the uranium in the coal. Batch extraction of the Wyoming coal with 6N hydrochloric acid leads to the solution of almost 90% of its uranium. Recovery of uranium is independent of the particle size of the coal between -4 and -20 mesh, and is accompanied by the solution of approximately 70% of the inorganic constituents (ash) of the coal. The extract contains, together with uranium, a concentration of several elements such as manganese, cerium, and vanadium that are present in the coal. Fischer assays of this weathered coal from the Red Desert indicate a yield of 16.7 gallons of tar per ton. Yields of both tar and char are about 15% lower if the coal is first treated with 6N hydrochloric acid to extract the uranium. It is suggested that uranium was introduced into the coal by means of ground water carrying soluble alkaline or alkaline earth uranyl carbonate complexes. The mineral schroeckingerite—a similar complex—is found near this subbituminous coal in the Red Desert of Wyoming. These complexes, which are unstable in acid medium, release the uranyl ion (UO_2^{++}), which may then react with organic constituents of the coal to form ionic uranyl-organic compounds that are insoluble above a pH of about 2.2. Preliminary data indicate that the uranium is associated with various humic components of the coal. The distribution of uranium among the components of the subbituminous coal from Wyoming is similar to the distribution in a lignite from South Dakota. There is no indication that uranium was introduced into or retained by the two coals by appreciably different geochemical processes. (auth)

7338

STILLWELLITE, A NEW RARE-EARTH MINERAL FROM QUEENSLAND. J. McAndrew and T. R. Scott (Commonwealth Scientific and Industrial Research Organization, Melbourne). *Nature* 176, 509-10(1955) Sept. 10.

7339

GEOLOGY OF THE NATURITA NW QUADRANGLE,

COLORADO. GEOLOGIC QUADRANGLE MAP GQ-65.

Fred W. Cater, Jr. Washington, U. S. Geological Survey, 1955.

7340

PRELIMINARY GEOLOGIC MAP OF THE ROC CREEK QUADRANGLE, COLORADO. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 23. E. M. Shoemaker. Washington, U. S. Geological Survey, 1955. \$0.50.

7341

MAP SHOWING DISTRIBUTION AND OCCURRENCES OF URANIUM DEPOSITS IN PART OF THE EDMONTON MINING DISTRICT, FALL RIVER COUNTY, SOUTH DAKOTA. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-39. W. A. Braddock. Washington, U. S. Geological Survey, 1955. \$0.50.

METALS AND METALLURGY

7342 A-1113

[Chicago. Univ. Metallurgical Lab.]

A SIMPLE GLOBAR HEATING ARRANGEMENT. E. Creutz. July 22, 1943. Decl. June 29, 1954. 4p. (MEMO-104)

Globars are silicon carbide rods or tubes. A sintering furnace is described which uses globars with ends of lower resistance material for making electrical contact. Graphite, embedded in thermal insulation material, serves as a muffle. Such a furnace may be operated at temperatures up to 1500°C, and modifications are described for providing an inert atmosphere. (C.H.)

7343 AECD-3676

National Research Corp., Cambridge, Mass.

THE DEVELOPMENT OF A MELTING METHOD FOR CONVERSION OF ZIRCONIUM SPONGE TO CORROSION RESISTANT INGOT. May 4, 1950. Decl. with deletions Dec. 21, 1953. 12p.

An investigation of the feasibility of producing corrosion-resistant Zr, free from Hf and other impurities of undesirable neutron cross sections, from sponge by special melting techniques is presented. (J.E.D.)

7344 BM-RI-5149

Bureau of Mines.

ARC INGOT CONDITIONING BY SIDEWALL FUSION.

F. W. Wood, J. O. Borg, and R. A. Beall. Mar. 1955. 13p.

A revision of USBM-U-1 issued August 1954 by the Northwest Electrodevelopment Lab., Albany, Oreg., with identical title and authors.

Ingots of zirconium and other highly reactive metals such as titanium and hafnium produced by the consumable-electrode arc-melting process require conditioning before forging or rolling. A nondestructive, arc-conditioning technique has been developed as a substitute for lathe conditioning. The technique employs an electric arc under an inert atmosphere to fuse surface metal on the sidewalls of ingots without seriously affecting the general quality of the ingots. Advantages of the practice are increased yields, lower accumulation of inferior scrap, and actual cost savings. The work cited in this report was done on zirconium. (auth)

7345 BMI-T-23

Battelle Memorial Inst., Columbus, Ohio.

THE VARIATION WITH TEMPERATURE OF THE DYNAMIC

MODULUS OF ELASTICITY AND THE INTERNAL FRICTION OF ZIRCONIUM. A. D. Schwoppe and G. T. Muehlenkamp. Apr. 20, 1950. Changed from OFFICIAL USE ONLY Feb. 21, 1955. 14p. Contract NObs-46822, [Affiliated with W-7405-eng-92].

The variation with temperature of the dynamic modulus of elasticity and the internal friction of both the arc-melted Bureau of Mines sponge and crystal-bar zirconium were studied. The method adopted is one in which the modulus is derived from the measurement of the natural frequency of a free-free beam in transverse vibrations. The internal friction is derived from the measurement of the width at half amplitude of the resonant frequency curve. In this method, the stress, and consequently the strain, to which the specimen is subjected is very small, and thus plastic deformation and its effect on the internal friction is minimized. (auth)

7346 ERI-1993-16-F

Michigan. Univ., Ann Arbor. Engineering Research Inst. MACHINING TITANIUM. Final Report. Production Engineering Dept. O. W. Boston, R. M. Caddell, L. V. Colwell, R. E. McKee, K. F. Packer, and P. R. Visser. June 1955. 105p. Project 1993. Contract 20-018-ORD-11918.

The objective of the project in machinability was to determine from a series of tests the machinability characteristics when cutting titanium and several of its alloys when face milling, turning, tapping, broaching, drilling—conventional and deep hole—and reaming, shaping, and sawing. For sake of background, a plain carbon steel and a stainless steel were similarly tested. The list of materials tested is given. Cutting speeds for given tool life, unit net horsepower at the cutter, which is the horsepower at the cutter required to remove one cubic inch of metal per minute, surface quality, and cutting temperatures are used as a basis of comparison. Tests in all processes were run with tools made of high-speed steel, and some tests in face milling, turning, and drilling were made with tools of sintered carbide. (auth)

7347 MAB-97-M

National Research Council. Materials Advisory Board. THE PROCESSING AND RE-USE OF TITANIUM SCRAP. Sept. 16, 1955. 57p. Contract DA-49-025-sc-83.

The generation of Ti and Ti alloys scrap, accumulation, segregation, and processing, the converting of Ti and Ti alloys into useful scrap, refining and reuse of contaminated scrap, research and development effort to facilitate scrap reuse, and the cost of reusing scrap by various means are discussed. Individual summaries of activities in Ti scrap recovery as based on information from contributing organizations are reported. A flow diagram of the fabrication of Ti sheet products showing scrap generation, processing, and recovery based on 50% scrap feed to melting furnace is attached. (J.E.D.)

7348 NACA-TN-3512

Lewis Flight Propulsion Lab., Cleveland.

EFFECT OF SOME SELECTED HEAT TREATMENTS ON THE OPERATING LIFE OF CAST HS-21 TURBINE BLADES. Francis J. Clauss, Floyd B. Garrett, and John W. Weeton. May 13, 1955. 39p.

Effects of heat treatment depend upon initial microstructure of cast blades. Blades from one manufacturer performed best in the as-cast condition; blades from a second

manufacturer performed best after aging 48 hours at 1500°F. Solution treatments at 2050°F and above often caused damage by eutectic melting. Before the full benefits of heat treatment can be realized casting conditions must be controlled to produce uniform structures with finely distributed carbides and a minimum of interdendritic segregation. (ASTIA- auth)

7349 NP-5752

Mine Safety Appliances Co., Callery, Penna.

SODIUM PLUGGING OF VENT LINES. E. C. King and V. K. Heckel. Sept. 7, 1955. 11p. Contracts N9onr-85801 and NObs-65426, Technical Report No. 42.

The distance sodium will travel in a copper or stainless steel pipe or tube of inside diameter between 0.180 to 0.622 in. can be calculated to within an accuracy of ± 3 ft from the equation: $S = (4 k_w d / k_w - 8.9 + 4 k_w d) (1020 d / 208 - T_a + 18.08 d - 3059 / d - 0.1258)$ where S is the distance of sodium travel in ft, k_w is the thermal conductivity of the tube wall in Btu/hr-sq ft-°F/ft, d is the inside diameter of tubing in in., and T_a is the ambient temperature in °F surrounding the tube, or the tube wall temperature. (auth)

7350 NP-5769

Crane Co., Chicago

RELAXATION BEHAVIOR OF TITANIUM ALLOYS.

Quarterly Progress Report No. 5. E. A. Sticha. July 15, 1955. 9p. Contract AF33(616)-2400.

Preliminary tests were conducted to evaluate the relaxation characteristics of certain Ti alloys which may be used for fasteners at high temperatures. The effect of relaxation testing on hardness and impact resistance is tabulated. (auth)

7351 NYO-6327

Pittsburgh. Univ.

APPLICATION OF CHEMICAL THERMODYNAMICS TO THE STUDY OF ALLOY FORMATION. PROGRESS REPORT FOR APRIL 1, 1955 TO JULY 1, 1955. W. E. Wallace, R. S. Craig, W. V. Johnston, G. S. Kamath, K. F. Sterrett, T. R. Waite, and M. G. Zabetakis. July 11, 1955. 5p. Contract AT(30-1)-647.

The heats, entropies, and free energies of formation of $MgCd_3$ and Mg_3Cd at 25°C have been computed. (For preceding period see NYO-6325.) (auth)

7352 SO-2041

General Electric Co. Research Lab., Schenectady, N. Y. FUNDAMENTAL RESEARCH IN PHYSICAL METALLURGY. Twenty-Sixth Quarterly Report. (Progress Report No. 43). J. H. Hollomon and D. Turnbull. July 5, 1955. 7p. Contract W-31-109-Eng-52. (55-RL-1384)

The coefficient of self-diffusion of thallium into silver-thallium alloys, as a function of temperature and thallium concentration, is reported. The heat capacity of graphite over the temperature range below 3°K can be described by an aT^3 term, associated with the lattice vibrations, and a linear term that may be associated with the electronic specific heat. (auth)

7353 SO-2521

General Electric Co. Research Lab., Schenectady, N. Y. THE TENSILE CHARACTERISTICS OF PARTICLE-STRENGTHENED ALLOYS OF ZIRCONIUM WITH IRON. J. H. Keeler. Aug. 1955. 30p. Contract W-31-109-Eng-52. (55-RL-1341)

The tensile characteristics of zirconium-iron binary alloys containing up to 5 at.% iron are reported for the

temperature range -195 to 500°C. A linear relation between stress at constant strain and volume fraction $ZrFe_2$ was found. The coincidence of data from unalloyed zirconium with zero volume fraction $ZrFe_2$ indicated little or no solid solution in alpha zirconium. The absolute increase in strength due to particle strengthening, although decreasing with increasing temperature, was greater percentagewise at high temperature. (auth)

7354 TML-5A

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

THE USE OF TITANIUM ALLOY SHEET IN AIRFRAME COMPONENTS. L. R. Jackson. July 29, 1955. 22p. Contract AF18(600)-1375.

This report presents quantitatively significant strength-weight criteria for Ti sheet alloys against a background of similar criteria for alternative sheet material, in order to provide a realistic basis for judging the circumstances under which it may be used in airframe components. Results of tests of tensile strength, yield strength, compression strength, elastic modulus, and buckling are included. (D.E.B.)

7355 TML-12

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

FORMABILITY TESTS OF TITANIUM ALLOY SHEET. L. R. Jackson. July 20, 1955. 24p. Contract AF18(600)-1375.

A discussion of the properties of Ti alloy sheet and their effect on formability is presented. (D.E.B.)

7356 TML-13

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

THE SELECTION OF MATERIALS FOR HIGH-TEMPERATURE APPLICATIONS IN AIRFRAMES. S. A. Gordon. Aug. 5, 1955. 38p. Contract AF18(600)-1375.

It is intended that this report be considered as a supplement to TML-5A.

The airframe industry was surveyed to determine the methods used in the selection of material for application in airframes to determine the relative position of Ti with competing materials. The factors, strength-density ratio, fabricability, availability, dependability, time-temperature effect, and cost are found to be criteria. A comparison of Ti and some commonly used airframe metals is made. (D.E.B.)

7357 WADC-TR-54-278(Pt.II)

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

TITANIUM ALLOYS FOR ELEVATED TEMPERATURE APPLICATION. Covers Period of Work from June 1954 to December 1954. W. F. Carew, F. A. Crossley, and D. J. McPherson. July 1955. 111p. Project Title: METALLIC MATERIALS. Task Title: TITANIUM METAL AND ALLOYS. Contract AF 33(038)-22806.

Room- and elevated-temperature tensile, creep-rupture, and stability tests were made for a number of Ti-Al and Ti-Al-Mo alloys containing B, Be or C as dispersion or precipitation strengtheners and for the new ternary compositions Ti-5% Al-5% Mo, Ti-6% Al-4% Mo and Ti-6% Al-6% Mo. Alloys containing 5% Al-5% Mo, 6% Al-4% Mo and 7% Al-3% Mo were quite successfully fabricated to 0.060 in. sheet. Variations in the previously

recommended heat treatment for the Ti-7% Al-3% Mo alloy were studied with the aim of increasing commercial practicability. The notched specimen fatigue endurance limit of Ti-7% Al-3% Mo ($K_t = 1.8$) was determined to be 43,000 to 45,000 psi. Studies of the effects of sponge quality, alloy content variations, and forging practice on the properties of Ti-7% Al-3% Mo were made. (For preceding period see WADC-TR-54-278(Pt.I).) (auth)

7358 WADC-TR-54-595

Thompson Products, Inc. Chemical and Metallurgical Lab., Cleveland.

RESEARCH INVESTIGATION OF THE FORGING CHARACTERISTICS OF ALUMINUM POWDER METALLURGY PRODUCTS. G. D. Dolch, F. E. McBride, J. P. Long, and R. A. Paetz. Mar. 1955. 100p. Project title: METALLIC MATERIALS. Task title: ALUMINUM ALLOYS. Contract AF33(616)-2091.

Three aluminum powder metallurgy products were forged into gas turbine compressor rotor blades to determine if these materials were amenable to such processing. Forgeability was evaluated through a series of temperatures under various types of working, including: rolling, flat forging, upsetting, extruding, blocking, coining, and trimming. The effect of forging temperatures on stress-rupture, tensile and fatigue strengths was evaluated by means of specimens prepared from flat forgings. Also, stress-rupture, tensile, and fatigue strengths, along with impact data were obtained on the as-received bar stock for a comparison base line. Using strength data as a means of appraisal, one material and its optimum forging temperature were selected. Finished compressor blades were processed in accordance with optimum material-forging conditions, and subjected to limited fatigue and metallographic evaluation. It was found that these materials could be processed into finished compressor rotor blades by substituting extrusion for rolling, and that processing is possible in the temperature range of 500 to 1000°F. The two materials with oxide contents in the vicinity of 14% were found to have room temperature strengths comparable to a heat treated wrought aluminum alloy currently used for compressor rotor blades. However, the elongation and impact properties at all temperatures tested were inferior to the wrought aluminum alloy. (auth)

7359 AEC-tr-2231

SOME PHYSICAL PROPERTIES OF Pb-Sb ALLOYS. V. A. Yurkov. Translated by S. J. Rothman from *Doklady Akad. Nauk S.S.S.R.* 91, 891-3(1953). 6p.

The results of investigations of the coefficient of linear expansion, density, resistivity and thermo emf of Pb-Sb alloys, carried out in accordance with the above specified requirements are described. According to the data at hand, the eutectic corresponds to an alloy containing 13% Sb. The eutectic temperature is 247°C. The alloy Pb-Sb usually forms a pure eutectic. (auth)

7360 AEC-tr-2233

THE STUDY OF VOLUME AND GRAIN BOUNDARY DIFFUSION IN METALS BY THE AUTORADIOGRAPHIC METHOD. S. Z. Kokshtein, S. T. Kishkin, L. M. Moroz, and T. I. Gudkov. Translated by S. J. Rothman from *Doklady Akad. Nauk S.S.S.R.* 102, 73-5(1955). 7p.

The interactions in the solid solution of tin in iron on the one hand, and tin in nickel on the other hand, are different. In the second case the atoms move preeminently along the

grain boundaries. In the first case the main mass of the tin atoms moves frontally into the mass of the grain. This difference can probably be explained on the basis of the difference of the surface properties of these elements. In any case, the difference between the surface energies between nickel and tin at a temperature near the melting point is greater than the difference between the surface energies of iron and tin. However this explanation is insufficient, as the difference in the structure of the lattice and of the grain boundary also has great importance. The difference in the characters of the diffusions can hardly be explained by the difference in mutual solubilities, as the solubility of tin in nickel is hardly greater than in iron. (auth)

7361 AEC-tr-2236

AN ELECTROCHEMICAL INVESTIGATION OF THE SYSTEM Sn-Na. Yu. (Iu.) K. Delimarskii and A. A. Kolotii. Translated from *Zhur. Fiz. Khim.* 28, 1169-73(1954). 12p.

An abstract of this paper appears in *Nuclear Science Abstracts* as NSA 8-6944.

7362

METALLURGICAL ASPECTS OF SILVER BRAZING TITANIUM. N. A. Tiner (North American Aviation, Inc., Downey, Calif.). *Welding J. (N. Y.)* 34, 846-50(1955) Sept.

An investigation is made on the metallurgical aspects of silver brazing of titanium by the methods which employ inert-gas shielding. The silver-titanium constitution diagram is discussed, and the solubility of titanium in molten silver at 1800°F is determined to clarify the silver-rich corner of the constitution diagram. The microstructure of the various zones produced at the silver-titanium interface by the three inert-gas-shielded brazing methods is illustrated and the relation between the microstructure and the joint strength is pointed out. A new technique of induction brazing, using high temperature and long heating cycle, is brought to attention. The brazed joints made by this technique had very high shear strength, especially at elevated temperatures, even though the properties of the parent metal adjacent to the joint were somewhat impaired. (auth)

7363

WELDING OF CHROME-MOLY STEELS IN HIGH-PRESSURE HIGH-TEMPERATURE SERVICE. C. D. Cooper (Metal and Thermit Corp., Philadelphia). *Welding J. (N. Y.)* 34, 882-4(1955) Sept.

A new arc-welding system was developed for Cr-Mo steels used in high-temperature, high-pressure service. The system was designed for reverse polarity, direct current welding in all positions. It eliminates the danger of underhead cracking and reduces the normal preheat and postheating requirements for these steels. (auth)

7364

PROPERTIES AND CHARACTERISTICS OF A QUENCHED AND TEMPERED STEEL FOR PRESSURE VESSELS. W. D'Orville Doty (United States Steel Corp., Pittsburgh). *Welding J. (N. Y.)* 34, 425s-41s(1955) Sept.

The test results described have shown that quenched and tempered "T-1" steel in the plate thickness range common for pressure vessel construction possesses a unique combination of properties and characteristics, namely: (1) yield strength of at least 90,000 psi, (2) good low-temperature notch toughness, (3) ability to be welded without preheat or postheat, provided low-hydrogen type electrodes are used, and still remain tough as judged by notch-bend tests at low temperatures, (4) low susceptibility to straining and to strain aging, (5) uniformity of longitudinal tensile and transverse

ensile properties, and (6) ability to be gas cut without pre-heat or postheat and still be deformed appreciably at low temperatures. The fatigue strength (pulsating tension at 100,000 cycles) of welded "T-1" steel is low. However, the fatigue strength can be improved by a combination of stress relieving and peening and also by removal of weld reinforcements. (auth)

7365
DESIGN OF WELDED PRESSURE VESSELS USING QUENCHED AND TEMPERED STEEL. Leonard P. Zick (Chicago Bridge and Iron Co.). Welding J. (N. Y.) 34, 442s-444s(1955) Sept.

Nine welded pressure vessels made of T-1 steel, a quenched and tempered material, were tested to destruction. These tests dramatically indicated the strength and toughness of this material under both static and impact loads at low temperature and at stresses considerably above the ultimate strength of most materials now listed in the Codes. These tests raise new and shed light on many old controversial issues pertaining to the design of pressure vessels. Although one particular steel was used in the tests, many of the issues discussed apply more broadly to notch tough steels having high yield and ultimate strengths and high yield to ultimate strength ratios. Economic considerations suggest the utilization of the greater elastic strength by permitting allowable design stresses greater than one-fourth of the ultimate strength. The use of material having a minimum yield strength of 90,000 psi suggests design stresses greater than the yield of some carbon steels. Refinements of design details such as connections, junctions and attachments and increased inspection rule requirements may well be justified. (auth)

7366
SUITABILITY OF QUENCHED AND TEMPERED STEELS FOR PRESSURE-VESSEL CONSTRUCTION. Leon C. Bibber (United States Steel Corp., Pittsburgh). Welding J. (N. Y.) 34, 449s-64s(1955) Sept.

The amount of ductility needed for fabrication and operation, elastic ratios, relationship between ductility and toughness and necessity for stress relieving are discussed, in addition to describing destructive tests of 8 full-scale pressure vessels. (auth)

7367
ALUMINUM ALLOYS. Harry W. Fritts and Ralph L. Horst, Jr. (Aluminum Co. of America, New Kensington, Penna.). Ind. Eng. Chem. 47, 1946-52(1955) Sept.

A review of the industrial applications of Al and Al alloys is presented. The corrosion resistance of the alloys is discussed. (C.W.H.)

7368
IRON AND MILD STEELS INCLUDING LOW ALLOY STEELS. Homer L. Shaw (Battelle Memorial Inst., Columbus, Ohio). Ind. Eng. Chem. 47, 1982-5(1955) Sept.

The information published on iron, mild steels, and low-alloy steels during 1954 is summarized. (auth)

7369
NICKEL INCLUDING HIGH-NICKEL ALLOYS. H. O. Teplee (International Nickel Co., Inc., New York). Ind. Eng. Chem. 47, 1990-2006(1955) Sept.

The physical properties, composition, fabrication and working, and applications to the chemical industry of Ni and Ni alloys are reviewed. (C.W.H.)

7370

TITANIUM. H. B. Bomberger (Rem-Cru Titanium, Inc., Midland, Penna.). Ind. Eng. Chem. 47, 2041-3(1955) Sept.

The production, fabrication, surface treatment, and chemical and physical properties of Ti are reviewed. (C.W.H.)

7371

LESS COMMON METALS. E. M. Sherwood (Battelle Memorial Inst., Columbus, Ohio). Ind. Eng. Chem. 47, 2044-50(1955) Sept.

The preparation, properties, and industrial applications of Zr, Hf, Mo, Ta, Nb, and Re are reviewed. (C.W.H.)

7372

THE HISTORY OF THE MAGNESIUM, ZIRCONIUM, RARE EARTH, THORIUM ALLOYS IN THE FOUNDRIES OF THE UNITED STATES. Stewart A. Bohn. Metallurgia 52, 75-8(1955) Aug.

7373

APPARATUS FOR STUDYING IRRADIATED LIQUID METALS. R. J. Teitel (Brookhaven National Lab., Upton, N. Y.). Nucleonics 13, No. 7, 50-1(1955) July.

To study the effects of radiation on intermetallic compounds of U and Sn, photomicrographic specimens must be prepared. A method for their preparation is described and results presented. (D.E.B.)

7374

APPLICATION OF RADIOACTIVE INDICATORS FOR MEASURING THE VELOCITY OF DIFFUSION IN SOLIDS. A. A. Zhukhovitskii. Uspekhi Khim. 24, 575-83(1955). (In Russian)

A review. 15 references. (G.Y.)

7375

ALLOYS FOR USE AT HIGH TEMPERATURES. W. Betteridge. Brit. J. Appl. Phys. 6, 301-6(1955) Sept.

The properties necessary in metallic materials intended for service at high temperatures are outlined and the characteristics of nickel-base alloys for such applications are particularly described. The materials are dealt with in two classes: those primarily of value because of their resistance to oxidation and those characterized by high strength at elevated temperatures. (auth)

7376

METALLURGY IN NUCLEAR ENERGY. D. W. Lillie (General Electric Co., Schenectady, N. Y.). Metal Progr. 68, No. 3, 82-4(1955) Sept.

Progress in the metallurgy of U, Be, Zr, and graphite is briefly reviewed, one section being devoted to radiation effects. (J.E.D.)

7377

STAINLESS AND HEAT RESISTANT ALLOYS. V. N. Krivobok and E. N. Skinner (International Nickel Co., Inc., New York). Metal Progr. 68, No. 3, 118-22(1955) Sept.

The progress made in the metallurgy of alloys for high-temperature use covering Cr-Ni steels, Ni-base alloys, and Co-containing alloys is reviewed. (J.E.D.)

7378

ALLOYS IN Ti-Sn AND Ti-Al SYSTEMS. R. J. McClintick. Metal Progr. 68, 168, 170, 172-3(1955) Sept.

An investigation was made to determine the form of the Alpha-plus-beta region in Ti-Sn and Ti-Al alloys over a limited range of Ti-rich compositions. (auth)

7379

CORROSION RESISTANCE OF HIGH-MANGANESE STAIN-

LESS STEEL. H. E. McCune. Metal Progr. 68, No. 3, 206, 208, 210(1955) Sept.

The results show that the chromium-manganese steel has less ductility than the chromium-nickel steel which is probably due to the mixed austenite-ferrite structure. The ductility could probably be increased by increasing the manganese or nickel content to produce a completely austenitic structure. Although the chromium-manganese steel does not have the same high corrosion resistance as the chromium-nickel steel, it is still suitable for applications in which the requirement calls for an austenitic steel having corrosion resistance of approximately the same order as that of the straight chromium steels. (auth)

7380

CHROMIUM. A. H. Sully. New York, Academic Press, Inc., 1954. 272p.

Chapters are devoted to the history and occurrence, physical properties, production of Cr ferro-alloys and pure metal, melting and casting, powder metallurgy and workability, electroplating and properties of electrodeposits, chromizing reactions, and constitution and properties of Cr alloys. (J.E.D.)

7381

NEW STAINLESS STEELS QUALIFY FOR HIGH-TEMPERATURE SERVICE. PART I. E. A. Loria (Crucible Steel Co. of America, Pittsburgh). Iron Age 176, No. 13, 65-7(1955) Sept. 29.

Tests on new stainless steels show that they have the properties needed for high-temperature uses. Crucible HNM, a new austenitic stainless steel, exhibits a wide variety of mechanical properties depending on the heat treatment applied. The best combination of strength and ductility is obtained with a solution temperature of 2000°F, the cooling rate also being a factor. In this case, oil quenching was found to give the best properties. (auth)

7382

SOUND URANIUM INGOTS CAST USING CONSUMABLE ELECTRODE ARC-MELTING. F. R. Lorenz and W. J. Jurford (Westinghouse Atomic Power Division, Pittsburgh). J. Metals 7, 952-5(1955) Sept.

Uranium melting can be accomplished in either a partial vacuum or an inert atmosphere. Uranium is cast in a water-cooled copper mold, and the arc is established and maintained from a uranium electrode. These conditions obviate the melting contamination caused by certain atmospheres, by the graphite or refractory crucibles of induction melting, or by the tungsten tip in the non-consumable electrode type of arc melting. When the melting cycle is properly controlled sound uranium ingots are produced having no primary or secondary pipe or shrinkage cavities. Soundness is achieved with the additional cost and time for the remelt, and some surface conditioning treatment is also necessary. However, this could be accomplished with almost no sacrifice of material by a welding treatment to remelt the surface. Larger diameter ingots can be produced from smaller ones cast by other means without resort to any intermediate processing such as rolling out to strip or rod and chopping prior to remelting by nonconsumable electrode arc methods. Raw as-reduced metals, such as derby uranium, can be converted into useful solid shapes by fabricating an electrode from the raw material and then melting and casting into an ingot. Method provides a satisfactory means for remelting certain alloys to achieve homogeneity of alloying addition. (auth)

7383

WHAT YOU SHOULD KNOW ABOUT CLAD STEELS. Henry F. Peters (Lukens Steel Co., Coatesville, Penna.). Chem. Eng. 62, No. 10, 234, 236, 238, 240, 242(1955) Oct.

A general discussion on the application of clad steels is presented. The properly selected cladding material will prevent or reduce abrasion or corrosion, prevent contamination of substances in contact with the metal, and will supply the desired properties such as high strength, good electric conductivity, or properties suitable for bearing applications. (J.E.D.)

7384

THERMAL EXPANSION AND PHASE TRANSFORMATIONS OF LOW-EXPANDING COBALT-IRON-CHROMIUM ALLOYS. Peter Hidnert and Richard K. Kirby. J. Research Natl. Bur. Standards 55, 29-37(1955) July.

Coefficients of linear thermal expansion of some Co-Fe-Cr alloys are reported for various temperature ranges between -65° and +800°C, and the effects due to temperature, chemical composition, heat treatment, etc., were determined. Some of the alloys investigated have coefficients of expansion less than those for fused quartz and ordinary invar between -65° and +60°C. Some of the low-expanding Co-Fe-Cr alloys have γ - α transformations on cooling to low temperatures, and the resulting α -phase reverted to γ on heating to high temperatures. Ar₃ temperatures were observed as high as -10°C and Ac₁ temperatures at about 600°C. The effects of various heat treatments from -196° to +1,000°C on the transformations were investigated, and the resulting changes of thermal expansion were correlated with the structure of these alloys. (auth)

7385

TITANIUM IN IRON AND STEEL. George F. Comstock. New York, John Wiley and Sons, Inc., 1955. 294p.

The following topics on Ti in Fe and steel are discussed; titanium as a deoxidizer in rimmed and killed wrought steels; effects of Ti on N and S in steel, titanium in cast steel, cast Fe, and low-alloy steels, effects of Ti as the sole alloying element in pearlitic steels, carbide stabilization by Ti in unalloyed steels or steels of less than 42% alloy content, carbide stabilization by Ti in steels containing over 4% Cr, and Ti in precipitation-hardening steels and in complex heat-resisting alloys. (J.E.D.)

PHYSICS

7386 AECL-221

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

PAPERS PRESENTED BY A.E.C.L. STAFF AT THE MEETING OF THE ROYAL SOCIETY OF CANADA, HELD AT TORONTO, JUNE 6-8, 1955. Consists of two papers and an abstract: CROSS-SECTIONS OF (p,xn) REACTIONS IN HEAVY ELEMENTS. R. E. Bell and H. M. Skarsgard. SLOW NEUTRON SPECTROMETRY—A NEW TOOL FOR THE STUDY OF THE DYNAMICS OF CONDENSED SYSTEMS. B. N. Brockhouse. ANALYSIS OF INTERFERENCE BETWEEN TWO $J = 1/2^+$ STATES IN THE REACTION $C^{14}(p,\gamma_0)N^{15}$ (abstract). A. J. Ferguson, G. A. Bartholomew, H. E. Gove, A. E. Litherland, and E. B. Paul. 20p.

Six papers were presented by A.E.C.L. Staff at the 1955

Meeting of the Royal Society of Canada. Three of these are being published elsewhere.

Systematic measurements of cross sections of (p, xn) reactions in Bi^{209} and Pb^{208} have been made by the activation method. The experimental procedure is described, and cross section curves are presented. A technique for determining the energy distribution of monoenergetic neutrons after they have been scattered by a crystalline solid is described. Results are presented for scattering by vanadium and aluminum. (M.P.G.)

7387 AECU-3067

RAND Corp., Santa Monica, Calif.

THE LINDEMANN AND GRÜNEISEN LAWS. J. J. Gilvarry. Mar. 23, 1955. 35p. For Univ. of Calif. Radiation Lab. Contract [W-7405-eng-48], Subcontract SC-64. (RM-1446-AEC)

It is shown that the Lindemann fusion law can be derived from the theory of the temperature dependence of Bragg reflection of x rays. This law and the Grüneisen theory of solids are used in combination to yield an expression for the Grüneisen constant of the solid at melting in terms of fusion parameters. This relation is checked experimentally for 14 elements. (auth)

7388 AECU-3068

RAND Corp., Santa Monica, Calif.

THE EQUATION OF THE FUSION CURVE. J. J. Gilvarry. May 24, 1955. 25p. For Univ. of Calif. Radiation Lab. Contract [W-7405-eng-48], Subcontract SC-64. (RM-1496-AEC)

A generalization of the Lindemann law is used in conjunction with the Murnaghan equation of state for a solid to derive theoretically the empirical Simon equation for the fusion curve. For the alkali metals it is shown that experimental values of the temperature exponent in the Simon equation are quantitatively compatible with the theoretical evaluation given, and, furthermore, that the theory can predict approximate values of the exponent, in practice. (auth)

7389 NAA-SR-1367

North American Aviation, Inc., Downey, Calif.

SOLID STATE PHYSICS QUARTERLY PROGRESS REPORT [FOR] JANUARY-MARCH 1955. D. B. Bowen, ed. Sept. 15, 1955. 25p. Contract AT-11-1-GEN-8.

A survey is made of the effects of particle radiation on the properties of graphite. Calculations indicate that the initial damage consists almost entirely of interstitial-vacancy pairs produced by the first knock-on atom. Annealing behavior after irradiation in the temperature range 100° to 300°K has also been studied. Paramagnetic resonance experiments indicate that paramagnetic centers are formed by irradiation at about the same rate at liquid N temperature as at room temperature. Calculations of theoretical rate of defect production give good agreement to experimental values. The electrical resistivity, thermoelectric power, and thermal conductivity of graphite samples irradiated with 11-Mev cyclotron protons are given as a function of temperature. The changes in these properties with exposure were also shown. Experiments were also made on the stored energy release of cyclotron-irradiated graphite. An apparent negative stored energy near 100°K , indicative of increased specific heat, was found, and the spectrum is shown. A preliminary description is given on the effect of colloidal particles on the thermal conductivity of potassium chloride crystals. The experimental pro-

cedure is discussed, and detailed diagrams of the equipment are shown. Preliminary data are also given. Preliminary results were obtained from electron irradiation of copper at -196°C indicating that not all copper atoms receiving 25 ev are displaced in the lattice. Data on the annealing of this damage indicate practically no recovery between -185°C and -20°C . Three recovery states seem to exist at 25° , 130° , and 275°C . The mechanisms of recovery are discussed. Tensile properties of electron-irradiated 10 mil copper wires were compared to those of non-irradiated wires. Results show no apparent difference in ultimate strength. Helium impregnation and radiation damage of Th and U were studied after cyclotron α -particle irradiation. (For preceding period see NAA-SR-1286.) (B.J.H.)

7390 NAA-SR-1390

North American Aviation, Inc., Downey, Calif.

PERISCOPE FOR VIEWING HIGH LEVEL COBALT UNIT. Moses A. Greenfield and Roscoe L. Koontz. Sept. 15, 1955. 10p. Contract AT-11-1-GEN-8.

The necessity of viewing a 2000-C Co^{60} source required the design and construction of an optical system. The design of a system which permitted the source to be viewed through a $\frac{1}{2}$ by 1 in. channel 14 in. long while encased in a 12-in. thick Pb shield is given. Exposure at the viewing position was 1 mr/hr. (D.E.B.)

7391 NP-5764

Columbia Univ., New York. School of Engineering.

SOME REMARKS ON THE ENDURANCE LIMIT PROBLEM. Technical Report T-4a. Cyrus Derman. Aug. 1, 1955. 10p. Contract DA-30-069-ORD-1061. (CU-4-55-ORD-1061-IE)

The determination of the largest possible stress a standard test specimen can be subjected to and still not suffer fatigue failure is considered. The purpose of the experiment is to formulate the problem in the language of probability theory and to suggest a possible approach. (auth)

7392 NYO-6105

Buffalo. Univ.

THE PHYSICAL PROPERTIES OF COMPOSITE MEDIA. Edward H. Kerner. Jan. 12, 1955. 36p. Contract AT(30-1)-1440.

A general scheme for comprehending the characteristics of composite media is discussed. The cases of packed and suspended grains, both simple ones and coated ones, have been treated in detail and shown to be consistent with each other upon taking appropriate limits for various parameters. The case of gross anisotropy has been sketched and illustrated by the example of the cylindrical composite. An approach to the more involved question of the elastic properties of composite media has been suggested. (auth)

7393 OSR-TN-55-248

Princeton Univ., N. J. Forrestal Research Center.

A REVIEW OF VIBRATIONAL ENERGY EXCHANGE. Technical Note No. 20. Charles S. Tuesday. July 1955. 37p. Chemical Kinetics Project. Project OSR Chem. 50-4. Contract AF 33(038)-23976.

The general methods of measuring vibrational relaxation times (ultrasonic techniques, impact tube methods, shock tube methods, and interrupted radiation techniques) are reviewed as are the more important theoretical treatments of vibrational energy exchange and related experimental results. (auth)

7394 AEC-tr-2234

A DIFFUSION METHOD OF DETERMINING THE THERMODYNAMIC CHARACTERISTICS OF SOLID SOLUTIONS. A. A. Zhukovitskii, S. N. Kryukov, M. E. Yanitzkaya, and A. G. Golitzin. Translated by S. J. Rothman from *Doklady Akad. Nauk S.S.S.R.* 102, 121-4(1955). 6p.

A method for the determination of the thermodynamic characteristics of the components of solid solution is described. The basis of the method is the circumstances resulting from the linearity of the equation of diffusion and the use of radioactive elements. (auth)

7395 AEC-tr-2244

INVESTIGATION OF A POLARON SEMICONDUCTOR IN THE PRESENCE OF ELECTRIC AND MAGNETIC FIELDS. M. I. Klinger. Translated from *Zhur. Eksp'tl'. i Teoret. Fiz.* 26, 163-72(1954). 6p.

The fundamental self-consistent condition of a polaron in the presence of mutually perpendicular electric and magnetic fields is investigated. The question of the "break-up" of the polaron, caused by the applied electric field, is considered. (auth)

7396 AEC-tr-2246

MEASUREMENTS OF THE ABNORMAL LATTICE DISTURBANCES AND OF THE ELECTRICAL RESISTANCES IN THE SYSTEM $\text{ThO}_2\text{-La}_2\text{O}_3$. F. Hund. Translated from *Z. anorg. u. allgem. Chem.* 274, 105-13(1953). 9p. Available from Associated Technical Services (Trans. 81G6G), East Orange, N. J.

An abstract of this paper appears in *Nuclear Science Abstracts* as NSA 8-2371.

7397 AEC-tr-2248

THE USE OF A GAS DISCHARGE TUBE WITH A POINT CATHODE FOR THE VISUAL DETERMINATION OF THE SHAPE OF THE LINES OF FORCE OF AN INTENSE MAGNETIC FIELD. M. Ardenne. Translated from *Zhur. Eksp'tl'. i Teoret. Fiz.* 25, 749-50(1953). 3p. Available from Associated Technical Services (Trans. 00G7R), East Orange, N. J.

A method is described which enables the lines of force of the fields of large magnets to be observed visually. The electron beam in a discharge tube will travel in a helical path along the lines of force, and the electron beam will be visible if the discharge tube is filled with gas. The tube should have as low a pressure as possible to prevent scattering of the electron beam. This method can be used to study the change with time of the lines of force of magnetic fields varying at audio frequencies. (M.P.G.)

7398 AEC-tr-2249

DETERMINATION OF THE COEFFICIENT OF DIFFUSION IN PLASTIC DEFORMATION. (Opredelenie Koeffitsienta Diffuzii Pri Plasticheskom Deformirovani). S. I. Gubkin and S. A. Dovnar. Translated from *Doklady Akad. Nauk S.S.S.R.* 93, 1025-7(1953). 2p.

A description of a new method of determining the coefficients of diffusion and self-diffusion in the plastic deformation of a metallic body is given. The method is distinct in that it determines the coefficients of diffusion and self-diffusion directly in the process of plastic deformation. A table giving the sequence of operations in the experiment showing the nature of the method is attached. (auth)

7399 AERE-Lib/Trans-504

ON THE CLARIFICATION OF THE CONCEPTION OF THE EBERHARD EFFECT. Joseph Junkes. Translated by

F. Hudswell from *Z. wiss. Phot.* 36, 217-34(1937). 14p.

The Eberhard neighborhood effect in the development of photographic plates refers to the fact that the blackening of a field is affected by the blackening of the immediately adjacent parts of the photographic plate. A large variety of phenomena are associated with this effect, and some of them bear the same name. An attempt is made to clearly describe these phenomena and their connection with each other. (M.P.G.)

7400 AERE-Lib/Trans-510

THE VELOCITY OF RISING OF BUBBLES OF VAPOUR IN BOILER TUBES. F. Kaissling. Translated by F. Hudswell from *Forsch. Gebiete Ingenieurw.* 14B, 30-4(1943). 9p.

The measurements of Behringer prove that the flow of vapor through stationary boiling water in a vertical tube obeys the law of analogues and that the characteristic quantity which contains the velocity of the vapor is dependent on each of the other three characteristic quantities; they also show that there is no more simple law. The effect of the vapor content of the tube and the effect of the vapor pressure (characterised by the distance from the critical point) are the strongest. The effect of the characteristic quantity containing the tube diameter becomes greater as the quantity itself decreases (thus for example, the tube diameter) and as the vapor pressure decreases and as the vapor content increases. Limits are thus set on the use of tubes of small diameter at low vapor pressure or at high vapor content. The transformation of operational experience from one region into another is not advisable without a knowledge of the relationships presented. The tube was not heated in the experiments considered here, and therefore no vapor bubbles were formed on the walls of the tube; this is in contrast to many cases of practical operation. (auth)

7401 AERE-Lib/Trans-566

THE DISCOLORATION OF MAGNESIUM OXIDE CRYSTALS BY ITS OWN LATTICE MEMBERS. Heinrich Weber. Translated by F. Hudswell from *Z. Physik* 130, 392-402 (1951). 12p.

The discoloration of MgO crystals by an excess of one of the two components and by photochemical dissociations were studied. The experimental results are discussed. (auth)

7402 NACA-TM-1330

THEORY OF DYNAMIC CREEP. (K Teorii Dinamicheskoi Polzuchesti). A. A. Predvoditelev and B. A. Smirnov. Translated from *Vestnik Moskov. Univ.* 8, 79-86(1953). 12p.

An analysis is given of the causes of the increase in creep under varying loads. It is suggested that the increase in creep is due to local rise in temperature over the slip planes, thus facilitating slip. A theory of dynamic creep is proposed, based on the Becker theory of the after-effect, which treats the metal as a granular structure and includes a rate factor. Comparison of the theory with experimental results is reserved for a future paper. (auth)

7403 TT-553

DISCUSSION ON THE THEORY OF PHASE TRANSITIONS. (Diskussii k Teorii Fazovykh Perekhodov). I. Z. Fisher. Translated by D. A. Sinclair from *Zhur. Eksp'tl'. i Teoret. Fiz.* 21, 942-4(1951). 7p.

The theories of Vlasov, Bogoliubov, and Ursell and Mayer of liquid-crystal and liquid-gas transitions are discussed. Bogoliubov's is chosen to be most satisfactory for the description of the liquid-gas transition. (D.E.B.)

7404

A CIRCULATION-SYSTEM FOR ^3He . K. E. A. Effat and J. H. Fremlin (Univ. of Birmingham, England). *J. Sci. Instr.* **32**, 363-4(1955) Sept.

A system is described which enables He^3 to be reused in cyclotron experiments using accelerated ions of He^3 . The system uses a liquid air trap and a trap of activated charcoal at liquid air temperature to remove air, water vapor, and other residual gases while maintaining a high rate of flow of helium. The design and operation of the system are described. (M.P.G.)

7405

A SIMPLE METHOD OF DETERMINING THE SHRINKAGE FACTOR OF NUCLEAR RESEARCH EMULSIONS. P. J. Duke, W. O. Lock, P. V. March, and B. A. Munir (Univ. of Birmingham, England). *J. Sci. Instr.* **32**, 365(1955) Sept.

The shrinkage factor that occurs in nuclear emulsions as a result of processing can be measured with an accuracy of the order of 1%. A dial micrometer and a microscope are used, and the method is described in detail. (M.P.G.)

7406

POSITIVE-ION DRAINAGE IN MAGNETICALLY FOCUSED ELECTRON BEAMS. M. E. Hines, G. W. Hoffman, and J. A. Saloom (Bell Telephone Labs., Inc., Murray Hill, N. J.). *J. Appl. Phys.* **26**, 1157-62(1955) Sept.

In electron tubes utilizing long electron beams ionization of residual gases can produce a positive space charge which can partially or wholly neutralize the negative space charge of the beam. Such neutralization has, under special conditions, been successfully utilized in focusing electron beams. In certain electron devices requiring long electron beams, this type of focusing is inadequate and an axial magnetic field is employed to focus the electron beam. However, when magnetic focusing is used, the assumption is usually made that the electronic space-charge fields of the beam are not neutralized by positive ions. Measurements have been made on a magnetically focused electron beam yielding information on (a) the longitudinal drainage of positive ions from the electron beam and (b) the degree of positive-ion neutralization of the electron beam. It is pointed out that localized ion traps may be present in the beam if the beam diameter varies periodically along its length because of the applied magnetic field. (auth)

7407

DATA ON THE ATOMIC FORM FACTOR: COMPUTATION AND SURVEY. Ann T. Nelms and Irwin Oppenheim. *J. Research Natl. Bur. Standards* **55**, 53-62(1955) July.

This paper presents the results of calculations of atomic form factors, based on tables of electron charge distributions computed from Hartree wave functions, for a wide range of atomic numbers. Computations of the form factors for five elements—carbon, oxygen, iron, arsenic, and mercury—are presented and a method of interpolation for other atoms is indicated. A survey of previous results is given and the relativistic theory of Rayleigh scattering is reviewed. Comparisons of the present results with previous computations and with some sparse experimental data are made. (auth)

AEROSOLS

7408 USNRDL-TR-49

Naval Radiological Defense Lab., San Francisco.

A PHYSICO-CHEMICAL SYSTEM FOR WATER AEROSOL

MEASUREMENT. N. H. Farlow. May 25, 1955. 28p. Project title: COLLECTION AND MEASUREMENT OF LIQUID AEROSOLS AND DROPLETS FROM UNDER-WATER ATOMIC BOMB DETONATIONS.

The need for a durable, precision collecting surface for water aerosols has led to the development of a new transparent 35-mm film sensitive to distilled water and sea water fog droplets in the size range 1 to 100 μ . The droplet indicating film is polyvinyl alcohol containing silver nitrate and hydrogen peroxide coated on a substrate of 35-mm cellulose acetate film leader stock. A unique development process employing gaseous phenylhydrazine, ammonia, water vapor, and ultraviolet light from a sun lamp defines the impressions left by the droplets. The salt water impressions are sharply distinguished from distilled water spots by intense color differences. Large scale tests defining important variables and film sensitivity have been made. Special techniques are developed which allow collections of radioisotope tagged water droplets to be identified by radioautographic methods. To meet the requirements of a large scale field sampling program, instruments which automatically and continuously prepare, develop, and assist in the analysis of large volumes of the special film have been developed. (auth)

7409 USNRDL-TR-50

Naval Radiological Defense Lab., San Francisco.

CALIBRATION OF LIQUID AEROSOL COLLECTORS BY DROPLETS CONTAINING UNIFORM-SIZE PARTICLES.

N. H. Farlow and F. A. French. May 25, 1955. 20p. Project NS-081-001.

A simple and rapid method of calibrating aerosol droplet-collecting surfaces and instruments is necessary if accurate measurement of natural and artificial fogs is to be made. Calibration of such materials heretofore has been restricted to tedious and inaccurate methods none of which were reliable in the 1 to 10- μ diameter droplet range. Through the use of suspensions of single-size solid particles of spores and latex spheres in artificially generated aerosols, a technique was developed for the rapid determination of liquid micro-drop volumes which allows the complete calibration of droplet-sensitive films and sampling instruments, with a precision of 100 μ and possibly better. (auth)

COSMIC RADIATION

7410

THE PROTON COMPONENT OF COSMIC RAYS AT AIRCRAFT ALTITUDES. K. W. Ogilvie (National Research Council, Ottawa, Ont., Canada). *Can. J. Phys.* **33**, 555-64 (1955) Sept.

Experiments with a heavy particle selector installed in an aircraft show that the proton intensity in the energy range 230 to 480 Mev has a variation with height which is exponential, with absorption length 128 ± 10 gm/cm². The latitude effect between $\lambda = 40^\circ\text{N}$. and $\lambda = 56^\circ\text{N}$. is in general agreement with that found for fast (up to 5 Mev) neutrons. Some information has been obtained on the variation of the average specific yield for primary energies below 5 Bev. (auth)

7411

ON THE QUESTION OF ANTIPROTONS IN THE COSMIC RAY PRIMARY FLUX. M. I. Fradkin (Lebedev Physics Inst.).

Zhur. Eksptl'. i Teoret. Fiz. 29, 147-50(1950) Aug. (In Russian)

7412

INVESTIGATION OF THE HEAVY NUCLEI OF THE PRIMARY COSMIC RADIATION. H. Fay (Max-Planck-Institut für Physik, Göttingen, German). Z. Naturforsch. 10a, 572-81(1955) July. (In German)

The results of an investigation on heavy nuclei ($Z > 2$) of the primary cosmic radiation are described. The measurements were made in 40 stripped emulsions flown over Sardinia ($\lambda \sim 40^\circ$) in a height of about 27 km for 7 hours. The energy of the nuclei was deduced from their multiple Coulomb scattering, and, if they fragmented, from the opening angles of their secondary products. For the determination of the charge number Z the measurement of the δ -ray density was sufficient, all particles having energies/nucleon ≥ 1.2 Bev. The result is thus independent of possible influences of spurious scattering. The charge spectrum under an average of 32 g/cm² of residual material shows that the number of nuclei with $3 \leq Z \leq 5$ is approximately equal to that of nuclei with $6 \leq Z \leq 9$. This is in agreement with the charge spectrum found by Dainton, Fowler, and Kent, but at variance with the results of Bradt and Peters. The magnitude of the correction to be applied for the scanning loss of Li-nuclei is discussed. The correction factor used by Dainton et al. appears to be too high. With regard to the influence of the residual material it is shown that the calculated intensity of the Li, Be, and B nuclei at the top of the atmosphere will be strongly affected by the uncertainty of the probabilities p_k^i for fragmentation. The energy spectrum agrees with that deduced by Kaplon et al. from measurements of the latitude effect. It was found that because of spurious scattering cell lengths of at least 4 mm are required in order to measure energies > 4 Bev/nucleon. A spectrum similar to that found by Dainton et al. is obtained, if one confines the scattering measurements on cells which are not long enough. The flux of nuclei $Z \geq 6$ at the top of the atmosphere is somewhat smaller than measured by other authors at $\lambda = 41^\circ$. (auth)

7413

MOMENTUM SPECTRUM FROM SCATTERING IN LEAD OF SEA LEVEL PENETRATING SHOWER SECONDARIES. David L. Dye (Univ. of Washington, Seattle). Phys. Rev. 99, 1458-9(1955) Sept. 1.

A momentum spectrum of sea level penetrating shower particles has been determined from multiple Coulomb scattering angle measurements on tracks traversing two lead plates in a cloud chamber. The distribution of scattering angles is consistent with a differential momentum spectrum $N(p)$ proportional to p^{-1} for the range 0.6 to 2 Bev/c; and to p^{-2} for the range 2 to 6 Bev/c. (auth)

7414

SOLAR INFLUENCE ON THE ANISOTROPY OF PRIMARY COSMIC RADIATION. I. STUDIES AT LOW LATITUDES. V. Sarabhai, U. D. Desai, and D. Venkatesan (Physical Research Lab., Ahmedabad, India). Phys. Rev. 99, 1490-1502(1955) Sept. 1.

A study of the daily variation of meson intensity at low latitudes has been conducted with counter telescopes of identical design at Ahmedabad and at the mountain station of Kodalkanal. The analysis of the data shows that the semidiurnal component of variation, like the diurnal component, undergoes significant long-term changes. The appropriateness of a barometric coefficient applicable to the daily

variation of meson intensity is discussed. Long-term changes of the daily variation reveal that these are due to the addition or attenuation of a day and a night contribution, both of which are principally diurnal in character and at Ahmedabad have maxima at about 1300 and 0300 hours, respectively. For corroboration of these findings, data from 1937 to 1952, from the Carnegie Institution stations of Huancayo and Cheltenham have been analyzed. While at the equatorial station of Huancayo, the mechanism of change of daily variation is similar to what is observed at Ahmedabad and Kodalkanal, there are some differences in detail at Cheltenham, which lies in middle latitudes. There is evidence that some characteristics of the daily variation, notably the hour of maximum of the diurnal component and the amplitude of the semidiurnal component, follow the eleven-year solar cycle of activity. However, there is an indication that the nature of the composite daily variation, the hour of maximum of the semidiurnal component, and the pattern of addition and attenuation of the day and night contributions follow a 22-year cycle of change. The activity of the day and night contributions in relation to solar activity is discussed. (auth)

7415

CHANGES IN THE LOW-ENERGY PARTICLE CUTOFF AND PRIMARY SPECTRUM OF COSMIC RADIATION. Peter Meyer and J. A. Simpson (Univ. of Chicago). Phys. Rev. 99, 1517-23(1955) Sept. 1.

The low-rigidity cutoff for particles in the primary cosmic-ray spectrum has decreased within the period 1948 through 1951. This decrease corresponds to a 3° change (northward) in the "knee" position of the geomagnetic latitude curve for the nucleonic component. The phenomenon is accompanied by both a change in the primary spectrum for particle rigidities less than approximately 4 Bv and by an increase in total primary intensity. The spectral change is such that if the differential primary intensity, j , at low rigidities in 1948 was $j = C (p/z)^{-2}$; then the new spectrum for 1951 through 1954 is approximately $j \approx C' (p/z)^{-2.7}$. The total change of intensity arising from the changes in spectrum and low-rigidity cutoff is more than 13%. The measurements were obtained in 1948 and 1951, and have been confirmed and extended in November, 1954 using nucleonic component detectors. The vertical charged particle intensity was also measured and displays changes equivalent to those reported for the nucleonic component. Three regions of space are considered for the location of the mechanism producing the low energy cutoff; namely, the vicinity of the earth, the region of the solar system, and regions of the galaxy outside our solar system. Although the general solar dipole moment is at least an order of magnitude too small to account for the observations, it is concluded that the mechanism is operative within the solar system and is not a terrestrial phenomenon. (auth)

7416

COSMIC-RAY IONIZATION BURSTS IN AN UNSHIELDED 8-INCH PRESSURIZED SPHERE AT SEA LEVEL. Hugh Carmichael and John F. Steljes (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Rev. 99, 1542-50(1955) Sept. 1.

Two thin-walled ($\frac{1}{16}$ -inch steel = 1.22 g cm⁻²) spherical ion chambers, 8 inches in diameter, filled with best quality (99.8%) commercial cylinder A at 50 atmospheres, have been used to measure cosmic-ray ionization bursts near sea level. The bursts in one ion-chamber were measured by means of

a vibrating reed electrometer and in the other by an electrometer tube and dc feedback amplifier. The results from the two ion-chambers agreed to within 2% except that the smallest bursts could not be detected with the vibrating reed instrument. The integral size-frequency distribution of the bursts is given for sizes from 2×10^4 to 3×10^7 ion pairs and the corresponding frequencies range from 3×10^4 to 3×10^{-4} bursts per hour. The size-frequency distribution has been separated into five components identified respectively with single μ mesons, electrons, single protons, star processes, and extensive electron showers. These components have been resolved by comparison of the unshielded distribution with that obtained under 27-cm lead shield and the interpretation of their origin has been confirmed by coincidence experiments involving Geiger counters, a Cerenkov proton selector, and other ion chambers. The existence of a sharp kink in the size-frequency distribution curve, similar to that reported by Carmichael and Chou in 1939, is confirmed. (auth)

7417

ANALYSIS OF PROPERTIES OF SECONDARY PARTICLES IN NUCLEON-NUCLEON COLLISIONS AT VERY HIGH ENERGY. R. G. Glasser, D. M. Haskin, and Marcel Schein (Univ. of Chicago) and J. J. Lord (Univ. of Washington, Seattle). *Phys. Rev.* **99**, 1555-60(1955) Sept. 1.

Momentum measurements were made on the individual secondary particles emitted in the "outer" cone of the S star. A lower limit to the momentum of the particles in the "inner" cone was obtained. The transformation from the laboratory system to the center-of-mass system can be made, using suitable approximations, on the assumption that all charged secondaries are pions. This leads to a symmetrical angular and energy distribution with all particles included in a forward or backward cone of half angle 20° . The results are compared with various multiple production theories. It is possible to infer that there is no more than one pair of particles of protonic mass among the secondaries and that even the presence of one pair would violate symmetry. The number of K mesons must also be small. The methods of analysis should be useful on other events in this energy range. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

7418 UCRL-3112

California. Univ., Berkeley. Radiation Lab. SYSTEMATIC ABSENCES CORRESPONDING TO FALSE SYMMETRY. David H. Templeton. Aug. 19, 1955. 3p. Contract W-7405-eng-48.

The presence in a crystal of screw axes or glide planes is accompanied by certain systematic absences in the x-ray reflections. It is recognized that special arrangements of atoms can cause weak reflections which may be mistaken for systematic absences, especially in the cases of screw axes where the number of relevant reflections observed may be quite small. There exists, furthermore, a kind of special arrangement, of which an unlimited number of examples can be constructed, in which the absences will be indeed systematic but without the corresponding symmetry. This arrangement is briefly discussed in this note. (auth)

7419 AERE-Lib/Trans-534

THE LATTICE-THEORETICAL CALCULATION OF THE ENERGY OF IMPERFECTIONS IN SIMPLE IONIC CRYSTALS.

Peter Brauer. Translated by F. Hudswell from *Z. Naturforsch.* **7a**, 372-9(1952). 12p.

The lattice theory of simple ionic crystals is applied to imperfections which are formed as a result of wrong construction at lattice points. The distortion and the polarization are calculated for rock salt lattices which have been formed by the inclusion of a foreign ion at a lattice position or by the detachment of a lattice ion. The changed energy of the ion due to the distortion and polarization at the lattice point in question and the work of removal following upon it are calculated. Information is given on the applications. The problem of the solution of the Tl^+ ion in the NaCl and KCl is treated in detail. The result of the treatment is that Tl^+ ions will be dissolved freely in KCl but not in NaCl. This result is in agreement with the experimental result of Pringsheim and others. (auth)

7420 TT-548

TOWARDS THE ESTABLISHMENT OF A SCIENCE OF CRYSTAL OPTICS. PART I. THEORY OF DISPERSION. PART II. THEORY OF REFLECTION AND REFRACTION. (Zur Begründung der Kristalloptik. Teil I. Theorie der Dispersion. Teil II. Theorie der Reflexion und Brechung). P. P. Ewald. Translated by D. A. Sinclair from *Ann. Physik* (4), **49**, 1-38; 117-43(1916). 89p.

The theory of dispersion, reflection, and diffraction in finite crystals is discussed, and calculations are presented. The behavior of the crystal in the presence of x rays is included in the exact calculation. (M.P.G.)

ELECTRICAL DISCHARGE

7421 AEC-tr-2241

DELAY TIME IN THE FORMATION OF DISCHARGES IN AIR. I. E. Balygin. Translated from *Zhur. Tekh. Fiz.* **24**, 1187-93(1954). 7p. Available from Associated Technical Services (Trans. 54G6R), East Orange, N. J.

Delay time in the formation of discharges in air are investigated, and oscillograms of discharge patterns for various gap distances and pressures are presented. The total duration of discharge formation is found to depend on pressure and the magnitude of the overvoltage. (D.E.B.)

7422 AEC-tr-2242

BREAKDOWN OF SMALL AIR GAPS. I. E. Balygin. Translated from *Zhur. Eksptl'. i Teoret. Fiz.* **26**, 98-106(1954). 10p. Available from Associated Technical Services (Trans. 90G6R), East Orange, N. J.

Experimental data are presented on breakdown of small air gaps for various limiting discharge-channel currents. Oscilloscope patterns of voltage and current at the moment of breakdown and during subsequent burning of the spark reveal an intermittent deionization of the spark channel. Data are presented which show the existence of two separate discharge processes under the conditions indicated. The characteristic feature of the first of these is the frequent occurrence of peaks in voltage, because of the intermittent deionization of the spark gap, with subsequent spark-over under the simultaneous action of non-intermittent deionization, increasing exponentially with time. The characteristic feature of the second discharge process is the constancy of voltage at the gap electrodes during burning of the spark, despite the sharp drop in amplitude of the aperiodic applied pulse. Experimental data and calculations are presented, relative to the variation of discharge voltage of a strongly

ionized gap with the current which traverses the gap immediately before the spark. (auth)

ELECTRONS

7423 AEC-tr-2253

ON THE ELECTRON EMISSION FROM METAL SURFACES AFTER MECHANICAL WORK. J. Lohft and H. Raether, Translated from *Naturwissenschaften* 42, 66-7(1953). 3p.

Experiments are described in which the electron emission from freshly worked metal surfaces was observed at low pressures. A metal sample was brought into contact with a steel brush and immediately after to the input side of an electron multiplier. The impulses leaving the multiplier were conducted to a counting apparatus by way of an amplifier. A number of metals were examined for their emission and time rate of decrease in emission. The activity of the metals was found to be closely connected with their position in the periodic system, although deviations were observed. (M.P.G.)

7424

ON THE THERMAL IONIZATION OF TRAPPED ELECTRONS IN IONIC SOLIDS. J. H. Simpson (National Research Council, Ottawa, Canada). *Proc. Roy. Soc. (London)* A231, 308-20(1955) Sept. 6.

The ground state of an electron trapped at a defect of the interstitial ion type in an ionic crystal is determined by a variation method in which the interaction between electron and lattice vibrations is treated on a dynamic basis. The results are compared with static calculations using a self-consistent method, and it is shown that for certain ranges of the low- and high-frequency dielectric constants an appreciable difference in energy may occur. (auth)

7425

ANGULAR DISTRIBUTION IN ELECTRON-PHOTON SHOWERS WITHOUT THE LANDAU APPROXIMATION. B. A. Chartres and H. Messel (Univ. of Sydney, Australia). *Phys. Rev.* 99, 1604-5(1955) Sept. 1.

It is pointed out that the Tamm-Belenky approximate model will give an exact analytic expression for electron angular distribution in electron-photon showers. Three curves are obtained under this approximation, each using a different approximation to the elastic scattering law. It is shown that the Landau approximation introduces an error of 25% at small angles. The modified Landau approximation with $E_0 = 19$ Mev fits more closely. (B.J.H.)

7426

CONTRIBUTION TO THE STUDY OF ORBITAL ELECTRON CAPTURE BY NUCLEI. APPLICATION TO Kr^{79} . Pierre Radvanyi. *Ann. phys.* 10, 584-642(1955) July-Aug. (In French)

A review is given of the general aspects of the process of the capture of orbital electrons by nuclei, with particular attention being given to Kr^{79} . A complete description is given of a Wilson cloud chamber method for measuring the branching ratio of K capture to β^+ emission for Kr^{79} . Results for Kr^{79} give $\lambda_K/\lambda_{\beta^+} = 14.1 \pm 1.1$. Interpretations of this result are given, including a theoretical calculation of $\lambda_K/\lambda_{\beta^+}$ and a comparison to experiment. Other determinations of the decay scheme of Kr^{79} are discussed. L capture of Kr^{79} was also studied in the Wilson cloud chamber, and the ratio of L to K capture was found to be $\lambda_L/\lambda_K = 0.27 \pm 0.09$. L capture of Kr^{79} was also studied with a proportional counter giving $\lambda_L/\lambda_K = 0.257 \pm 0.030$. Theoretical values

of λ_L/λ_K were also obtained giving $\lambda_L/\lambda_K = 0.105$. The results are fully discussed. (B.J.H.)

INSTRUMENTS

7427 AECU-3074

David Sarnoff Research Center, Princeton, N. J. ELECTRONIC DEVICES FOR NUCLEAR PHYSICS. Quarterly Report No. 20 [for] May 1, 1955-July 31, 1955. Aug. 23, 1955. R. H. Anderson, M. H. Greenblatt, and A. H. Sommer. 26p. For [Oak Ridge National Lab.]. Contract W-7405-eng-26, Subcontract 308.

Development work has continued on a standard multiplier in combination with a "multi-alkali" photocathode of low thermionic emission. Experiments on the gain factor of dynodes indicate that dynodes activated with Cs have a higher gain factor than those activated without Cs and that Sb dynodes have a higher gain factor than Ag-Mg dynodes. Experimental tubes with Sb-Rb-K photocathodes have been constructed and are being tested. The design and performance of experimental high-speed high-current multiplier tubes is described. On the basis of the performances of three 9-in. cathode multipliers, it is believed that the manufacture of even a small number of usable tubes is not feasible at the present time. (For preceding period see AECU-3059.) (M.P.G.)

7428 AERE-C/R-1641

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A MODIFIED LATHE FOR TURNING SPECTROGRAPHIC CARBON ELECTRODES USED IN THE CATHODE LAYER ARC METHOD. A. V. Slatter and S. R. Stitch. Mar. 1955. 10p.

An apparatus is described for the production of thin carbon electrodes with a deep narrow boring suitable for use in cathode layer spectrographic analysis. The apparatus consists of an E. W. $2\frac{1}{2}'' \times 10''$ convertible lathe to which modifications have been made. (auth)

7429 AERE-GP/R-1596

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

RESONANT CAVITY PERTURBATION TECHNIQUE AT 200 MCS. J. H. Adlam and F. H. James. Apr. 26, 1955. 18p.

A description is given of a crystal controlled oscillator, and an oscillator which accurately follows the resonant frequency of a cavity. These two oscillators are used to measure the small changes in the resonant frequency of a cavity when it is perturbed by a small sphere. In this way shunt impedance and Q factor measurements may be made at 200 Mcs. (auth)

7430 NP-5761

Naval Air Experimental Station, Aeronautical Structures Lab., Philadelphia.

PERFORMANCE OF HIGH-TEMPERATURE STRAIN GAGES. [Covering Period] July 30, 1954-January 28, 1955. M. Bennon. June 16, 1955. 26p. (ASL-NAM-AD-298.1(Pt.1))

Five electrical, resistance-type, strain gages were tested to determine their potential usefulness for static structural-strain measurements under isothermal conditions at temperatures of 400°F and above, as required by current Naval Air Experimental Station test programs. Results ob-

tained indicate that the gages tested will not fulfill the requirements for use in current tests. However, three of the gages may have a limited usefulness for strain measurements where gage factor uncertainties and drift in strain gage output of the magnitude observed will be acceptable. Further investigation may supply a basis for correction of the strain-gage output to provide more satisfactory data. (auth)

7431 RAE-TN-INSTN-142

Gt. Brit. Royal Aircraft Establishment, Farnborough, Hants, England.

DEVELOPMENT OF AN AIR MASS-FLOW RATE METER.

W. J. G. Cox. Oct. 1954. 48p. (AD-50389)

The development of an Air Mass Flow rate meter to cover a very wide range is described which, essentially an analogue computer, gives a two-sweep pointer direct presentation of air mass flow rate, independent of pressure, temperature, and velocity changes within the range of the instrument. The pointers are driven by a servo system which is error-actuated from the computing bridge network, secondary feedback being employed to maintain stability with a saturated angular output rate of approximately 33° per second. Specifications and performance figures are given for the individual transducer elements and the complete instrument, error estimations are made, and the servo stability is discussed. (auth)

7432 SES-TN-2

Canada. Experimental Station, Suffield, Alberta.

A FEEDBACK VOLTAGE SUPPLY UNIT FOR USE WITH A PHOTOMULTIPLIER TUBE. W. L. Clink. Mar. 9, 1954. 5p.

An electronic power supply unit for a photomultiplier tube is described. Negative feedback of the output from the photomultiplier tube controls the voltage supplied by the unit. This voltage is a convenient function of the amount of light reaching the photosensitive cathode of the photomultiplier and is recorded continuously on a strip chart recorder. In this application the unit is used as a recording detector in a microphotometer system. (auth)

7433 UCRL-3062

California. Univ., Berkeley. Radiation Lab.

A COAXIAL MERCURY RELAY FOR FAST PULSE GENERATION. Val Fish, Jr. July 1955. Contract W-7405-eng-48.

Mercury relays are in general use as switching elements for the generation of μsec pulses. A typical system uses a coaxial cable one-half the electrical length of the pulse desired, which is switched into a load via another coaxial line. The relay, as manufactured, represents a serious impedance mismatch discontinuity between the two transmission lines. A simple modification capable of reducing this mismatch discontinuity to less than 1% may be accomplished for a few dollars and less than six manhours. A modified relay, when used in a line-type pulser, will produce measured pulses of 4.5×10^{-10} second into a 52-ohm cable. Pulse heights can be produced of 300 v or less to the extent of the interaction between driving coil and relay contacts (about 0.007 volt). Smaller pulse heights are obtainable from another model using a completely enclosed coaxial circuit. Wave forms as observed on a Tektronix 517 oscilloscope are shown. (auth)

7434 TT-552

SOURCES OF ERROR IN THE RECORDING OF HIGH SURGE

VOLTAGES BY MEANS OF THE CATHODE RAY OSCILLOGRAPH. (Fehlerquellen bei der Registrierung hoher Stoss-Spannungen mit dem Kathodenstrahl-Ozillographen). R. F. Goossens and P. G. Provoost. Translated by H. A. G. Nathan from. *Bull. schweiz. elektrotech.*, Ver. 37, 175-84(1946). 27p.

The recording of high surge voltages by means of the cathode ray oscillograph with the use of ordinary circuits involves errors of measurement. The magnitude of these errors is determined theoretically and experimentally. The following problems are dealt with: the high-voltage arm of the potential divider, measurements on a delay cable, and mounting of test piece and potential divider. (auth)

7435

X-RAY DIFFRACTION CHAMBER FOR THE STUDY OF LIQUIDS AT HIGH TEMPERATURES. Jerzy (Georges) Zarzycki. *Compt. rend.* 241, 480-1(1955) Aug. 1. (In French)

Complete descriptions and diagrams are given of an x-ray-diffraction chamber allowing the study of specimens in the liquid state at temperatures up to 1600°C. (B.J.H.)

7436

D-C AMPLIFIER FOR REACTOR CONTROL. E. J. Wade and R. S. Stone (Knolls Atomic Power Lab., Schenectady, N. Y.). *Nucleonics* 13, No. 4, 28-30(1955) Apr.

Circuit diagrams and a discussion of the operation of a d-c amplifier for reactor control use is presented. Distinguishing features are low drift and fast response. (D.E.B.)

7437

A STRESS-STRAIN MACHINE FOR TESTING SINGLE CRYSTALS IN ALTERNATING TENSION AND COMPRESSION. M. S. Paterson (Australian National Univ., Canberra). *J. Sci. Instr.* 32, 356-61(1955) Sept.

A testing machine for single crystals is described by means of which the stress-strain behavior in cycles of alternating tension and compression can be measured. Special precautions are taken to eliminate external bending or torsion of the specimen. The load and extension gauges are of the roller and mirror type for high sensitivity. The difficulty of gripping a single crystal firmly without damaging it is overcome by using a chuck in the form of a mould into which the crystal is cast with solder. Examples of the performance of the machine are given. (auth)

7438

THE DETECTION OF THE LEVEL OF LIQUID SODIUM IN STAINLESS STEEL TUBES. E. W. Pulsford (Atomic Energy Research Establishment, Harwell, Berks, England). *J. Sci. Instr.* 32, 362-3(1955) Sept.

The level of liquid Na in a stainless steel tube can be determined by observing the change in inductance of a narrow coil of wire wound around the tube as the liquid surface passes through it. Two similar coils are used connected in a standard inductance bridge circuit. An abrupt change in the state of balance of the bridge indicates when the liquid is treading one of the coils. A circuit diagram is given. (M.P.G.)

ISOTOPES

7439

PRODUCTION AND ISOLATION OF CARRIER-FREE RADIOACTIVE ISOTOPES. A. N. Murin, V. D. Nefedov and

I. A. Yutlandov. *Uspekhi Khim.* **24**, 527-74(1955). (In Russian)

A review. 128 references. (G.Y.)

7440

TRITIUM ISOTOPE EFFECT IN THE ISOMERIZATION OF CYCLOPROPANE. Ralph E. Weston, Jr. (Brookhaven National Lab., Upton, N. Y.). *J. Chem. Phys.* **23**, 988(1955) May.

The variation in the kinetic isotope effect in the isomerization of tritium-labeled cyclopropane to propylene as a function of pressure was studied. The complete disappearance of the isotope effect in the low pressure region indicates the validity of the Lindemann mechanism, and of the assumptions about the rates of collisional energy transfer. (C.W.H.)

ISOTOPE SEPARATION

7441 AECU-3070

Michigan. Univ., Ann Arbor.

SILVER-111 BETA RAY SOURCES. W. Wayne Meinke and D. N. Sunderman. [1955]. 12p. [Project 7. Contract AT(11-1)-70].

A rapid decontamination method is described for the separation of Ag^{111} from neutron-bombarded Pd by isotopic exchange. This method makes possible the routine production of large Ag^{111} β sources. (B.J.H.)

7442 CEA-308

France. Commissariat à l'Énergie Atomique, Paris. RÉALISATION D'UN SÉPARATEUR ÉLECTROMAGNETIQUE D'ISOTOPES. APPLICATION À L'ÉTUDE DES ISOTOPES DE MASSE 93 DU MOLYBDÈNE ET DU TECHNETIUM. [Realization of an Electromagnetic Isotope Separator. Use to the 93 Mass Isotope Study in Molybdenum and Technetium]. René Bernas. July 1, 1954. 114p.

Thesis submitted to the Univ. of Paris.

The analysis of the focusing properties of homogeneous magnetic fields led to the use of a 60° sector field in the construction of an electromagnetic isotope separator. The ion sources built for this instrument have an ion output of over 10 ma. Ion beams at the collector vary between 1 and 5 ma. A resolving power of 125 is obtained for 1 ma collector current. A study of space charge neutralization has included the part played by negative ions and a measure of the time necessary to achieve complete neutralization. The space charge neutralization method employed has given very satisfactory results. An account of several separations is given including elements such as mercury, bromine, thorium, etc. The use of the separator in the study of some isomeric transitions in molybdenum and technetium has resulted in the definite assignment to Mo^{93} and Tc^{93} of two γ rays of 260 and 390 kev. A new method for a rapid separation of technetium from molybdenum is described. (auth)

MATHEMATICS

7443 LA-1872

Los Alamos Scientific Lab., N. Mex.

TABLE OF $\sin^2 X$; $X = [0^\circ(0.001^\circ)45^\circ; 5D]$. Ruth M. Gilmer and Harwood G. Kolsky. [nd] 91p. Contract [W-7405-eng-36].

7444 LA-1943

Los Alamos Scientific Lab., N. Mex.

RATIONAL APPROXIMATION OF FUNCTIONS. Bengt

Carlson and Max Goldstein. Aug. 1955. 46p. Contract W-7405-eng-36.

Rational approximations of the type derived by Cecil Hastings, Jr. have been found to be extremely useful in numerical work. A difference method well suited for high-speed computation has been developed for obtaining such continued products (polynomials) and continued fractions. A code for the IBM-Type 701 calculator, incorporating this method, is now available which rapidly and automatically computes the optimum approximation for an arbitrary degree n . Sets of polynomial and continued fraction approximations are given for the elementary functions. (auth)

7445 OSR-TN-55-261

Columbia Univ., New York. Electronics Research Labs. COMPLEX PLANE SCANNER—AN ANALOG COMPUTER. George Kranc, Peter Mauzey, and John Wuorinen. Aug. 1, 1955. 75p. Project No. 47501. Contract AF18(600)-962. (CU-8-55-AF-962-EE; T-2/F)

The theory, application, and certain specific circuits of a special type of electronic analog computer using sinusoidal voltages as analogs of phasors in the complex plane are reviewed. The circuits which make up the heart of the computer, its central unit, are explained in detail. (auth)

7446 UCRL-3056

California. Univ., Berkeley. Radiation Lab. ASYMPTOTIC PERTURBATION OF DIFFERENTIAL EQUATIONS (thesis). John Killeen. July 1955. 101p. Contract W-7405-eng-48.

The eigenvalue problems given by $d^2U/dX^2 + \{\lambda - q(X) - \epsilon p(X)\} U = 0$, $0 < X < \infty$, and $\nabla^2 U + \{\lambda - q(X, Y, Z) - \epsilon p(X, Y, Z)\} U = 0$, in ordinary three-dimensional space, are considered. It is assumed that ϵ is a small real quantity. The expansions for the eigenvalues and eigenfunctions which are given by formal perturbation theory are justified as asymptotic series, valid for a finite number of terms as $\epsilon \rightarrow 0$. The approximations are established rigorously up to second order by placing certain restrictions on the function p . (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

7447 AECU-3073

Los Alamos Scientific Lab., N. Mex.

PHOTOCATHODE AND REFLECTOR EFFECTS ON RELATIVE PULSE HEIGHT MEASUREMENTS. F. N. Hayes and Betty S. Rogers. [1954?]. 6p. Contract [W-7405-Eng-36].

Using a particular reflector, different photocathode tubes were compared as to the relative pulse heights produced in a liquid scintillator, and the data are tabulated. Also, certain tubes were used to exhibit the effects on relative pulse measurements of different emission spectra and reflectors. (B.J.H.)

7448 AERE-C/R-1358

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

PULSE ANALYSIS—A DISCUSSION OF EFFECTS IMPORTANT IN THE RADIOCHEMISTRY OF THE HEAVY ELEMENTS. K. M. Glover. Jan. 24, 1955. 14p.

This report gives a discussion of some of the principles involved in pulse analysis and of the types of counter suitable for this work, especially with the alpha emitters in the heavy element region. It is intended to show chemists the

kind of problems which pulse analysis can help to solve. (auth)

7449 AERE-EL/R-1616

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

PROCEEDINGS OF THE APPLIED NUCLEONICS CONFERENCE, BUCKLAND HOUSE, DECEMBER 4 AND 5, 1954. E. W. Pulsford, ed. 75p.

A general discussion is given on some of the characteristics of transistors. Circuits for scaler and gating unit applications of transistors are shown in detail. A detailed description is also given of the components of a geological field rate meter employing junction transistors. A survey is given of the general principles of experimental reactor instrumentation including radiation flux measurements, personnel monitoring instruments, industrial instrumentation, manual control and auto-control instrumentation, etc. A brief survey is given on work done with experimental reactors. An analog computer is being developed for reactor calculations. A survey is given of recent developments in circuit techniques, particularly amplifiers, pulse analyzers, and time-of-flight spectrometers. Plans for construction of a 1000-channel neutron spectrometer are given. Process instrumentation is surveyed. Typical examples of the monitor type process instruments, such as an α and β sampler in a liquid flow stream and an automatic U analyzer, are shown. The principles of chemical analysis by γ spectroscopy are discussed. (B.J.H.)

7450 AERE-HP/R-1585

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A DIFFERENTIAL IONISATION CHAMBER METHOD FOR CONTINUOUS FLOW MONITORING OF TRITIUM IN AIR IN THE PRESENCE OF A SIGNIFICANT GAMMA BACKGROUND AND WITH OCCASIONAL TRACES OF RADON IN THE SAMPLED AIR. L. W. D. Pittendrigh and J. E. Vousden. Dec. 6, 1954. 21p.

The instrument described consists of a differential ionization chamber designed to operate with a modified Type 1006 monitor. The air to be sampled for tritium is caused to flow continuously through one half of the chamber, where the effect of a γ flux in this half is cancelled out by the differential chamber arrangement. The instrument can operate without significant error in a uniform γ flux up to at least the maximum permissible level. The dose rate indicated is 0 to 90 times the maximum permissible daily concentration of tritium in air, and the integrated dose indicator reads up to 12 times the maximum daily dose without manual re-setting. Audible alarms are provided for both indicating systems. The presence of radon at 0.03 times the maximum permissible concentration in air causes no significant error in the readings. (auth)

7451 AERE-N/R-1639

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

DELAYS IN BF_3 PROPORTIONAL COUNTERS. K. P. Nicholson. May 6, 1955. 17p.

The nature of the time delays introduced into neutron time-of-flight measurements by the use of BF_3 proportional counters are discussed and some experimental results are presented. The frequency distribution of counter pulses as a function of delay time is shown to correspond closely to that expected from theory. The experimental results are

used to obtain a mean value for the mobility of electrons in BF_3 . (auth)

7452 AERE-NP/R-1667

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

FLUX MEASUREMENTS WITH THE BF_3 'LONG COUNTER.' W. D. Allen. June 8, 1955. 16p.

Flux measurements on the Harwell van de Graaff have been made by (1) determining the spectrum of recoils in a proportional counter in which a known volume is filled with hydrogen or methane (2) determining the response of a BF_3 'long counter' whose efficiency had been checked and calibrated by comparison with Ra-Be and photoneutron sources. Comparison of the two results gave initial discrepancies of about 20%, both in flatness of response and in absolute calibration. It was found that the discrepancies in flatness could probably be ascribed to the drying out of the borax filling which had been used in the outer shield of these original counters. A new long counter, made more closely to McKibben's original recipe (i.e. with outer shield of paraffin and borax) was reasonably flat in the MnSO_4 bath tests, although not quite so flat relative to the proportional counter. As regards absolute calibration, the discrepancy of 14% persisted when the long counter was calibrated against the Harwell standard Ra-Be source, even when all of the corrections have been allowed for. When, however, the long counter was calibrated against two Oxford Rd Th- D_2O sources of widely differing intensities (i.e. in the same energy range as the proportional counter) the agreement was within 2% and 1%, respectively, i.e. well within the limits of experimental error. It was also shown that, over a source-detector range of 9 feet the BF_3 counter behaves as a 'point detector.' The point at which the detector is 'centered' varies from 0.3" inside the inside face for 20 KeV neutrons to 1.9" inside the inside face for Ra-Be neutrons. The difference between 0.3 and 1.9" is by no means negligible for normal source-detector distances (30"-80"); in consequence, any statement about 'flatness of response' should specify the distance at which the counter has been calibrated. (auth)

7453 MLM-858

Mound Lab., Miamisburg, Ohio.

THE PREPARATION OF PLASTIC AND METALLIC ABSORBERS. Final Report. J. S. Stanton and J. W. Heyd. June 17, 1953. 17p. Contract AT-33-1-GEN-53.

Procedures are outlined for the preparation of plastic film, Al-foil, and Au-foil absorbers for use in energy measurements. The weight of these absorbers ranges from $\sim 2 \times 10^{-6}$ g/cm² to 10^{-1} g/cm². (C.W.H.)

7454 NP-5754

Massachusetts Inst. of Tech., Cambridge. Servomechanisms Lab.

ELECTRONIC NUCLEAR INSTRUMENTATION GROUP FINAL REPORT FOR THE PERIOD MARCH 1, 1952 TO JULY 31, 1955. Dept. of Electrical Engineering. T. S. Gray and A. B. Van Rennes. July 31, 1955. 38p. D. I. C. Project No. 6986. ONR Project NR-025-164. Contract N5ori-07876.

A final summary report is presented on research in neutron flux instrumentation systems. The need for rugged long-life components indicated the elimination of electron tubes and the use of semiconductors, magnetic elements, and dielectric elements. Preliminary subdivision of the objective into high- and low-level neutron instrumentation

was made, and promising components for each level were considered. For the high-level system, a neutron-sensitive thermopile, a magnetic-modulator pre-amplifier, a transistor carrier amplifier, and an output amplifier is felt to be most satisfactory. Two alternate neutron detectors were studied, a neutron beam modulator, and an electro-acoustic ionization chamber. System components considered for use in the low-level system include a proportional counter, a transistor pulse amplifier, and an output unit for pulse-rate conversion. Research done on system components and results of reactor tests on these systems are reported. (For preceding period see NP-5750. (D.E.B.)

7455 UCRL-4533

California. Univ., Livermore. Radiation Lab.

THIN PLASTIC SCINTILLATORS. Chris Lagiss. June 22, 1955. 7p. Contract W-7405-eng-48.

Many types of counting are more conveniently done with plastic scintillators than with their liquid equivalent. A method for preparing thin plastic disc for alpha and proton counting is described. (D.E.B.)

7456 USNRDL-TR-48

Naval Radiological Defense Lab., San Francisco.

THE EFFECT OF TEMPERATURE UPON THE RESPONSE OF A GAMMA-RAY SCINTILLATION SPECTROMETER. L. A. Webb. May 11, 1955. 14p. Project NS-081-001.

Studies have been made of the effect of temperature upon the scintillation efficiency of NaI(Tl) and the response of a 6292 photomultiplier over the range of 5 to 45°C. The samples used were 1-in. high by 1-in. diameter cylindrically-shaped NaI(Tl) crystals sealed in standard commercial packages with MgO reflecting surfaces and a Dumont Type 6292 photomultiplier. The crystals were coupled to the phototube by means of a special light pipe which permitted separate temperature control of the crystal package and of the photomultiplier while the operating condition of all other components remained unchanged. All temperatures were controlled within 0.1 degree by means of circulating oil. Temperature versus the pulse height output of the Cs¹³⁷ total absorption line, as recorded by a γ -ray scintillation spectrometer, shows a coefficient of $-0.14 \pm 0.02\%/^{\circ}\text{C}$ for NaI and -0.35 ± 0.02 for the photomultiplier tube. These values agree quite well with those obtained by others. (auth)

7457

STABILIZING SCINTILLATION SPECTROMETERS WITH COUNTING-RATE-DIFFERENCE FEEDBACK. H. de Waard (Nobel Inst. of Physics, Stockholm, Sweden). Nucleonics 13, No. 7, 36-41(1955) July.

A stabilization scheme is presented for eliminating the need for recalibration by providing long-term feed-back stabilization based on the location of an actual spectral peak. (D.E.B.)

7458

HOW TO INCREASE SENSITIVITY OF ALPHA-PARTICLE PHOTOGRAPHIC DETECTION. K. H. Sun and P. Szydlík (Westinghouse Electric Corp., East Pittsburgh). Nucleonics 13, No. 7, 48-50(1955) July.

A method for reducing exposure time by a factor of 20 to 160 in the photographic detection of α -particles is described. The method involves the use of Kodak Tri-X film, a fast developing procedure, and the use of a thin ZnS-Ag layer. (D.E.B.)

7459

BILATERAL DEVELOPMENT OF THICK NUCLEAR EMULSIONS. R. Fox and R. W. Wanlek (Harvard Univ., Cambridge, Mass.). Nucleonics 13, No. 7, 52-3(1955) July.

A method of bilateral development of thick nuclear emulsions is described. The mounting of the emulsion pellicle to prevent distortion is outlined. (D.E.B.)

7460

G-M WELL COUNTER FOR DETERMINING ACTIVITY IN LARGE VOLUMES. E. V. Weiner and R. E. Peterson (V. A. Hospital, Iowa City, Iowa). Nucleonics 13, No. 7, 54-5(1955) July.

An apparatus is described for measuring the radioactivity in liquid samples contained in 3-liter bottles. The apparatus consists of 6 vertical G-M tubes arranged in a circle. Operating characteristics are given, and a comparison with established commercial models is made. (D.E.B.)

7461

ESTIMATING Fe⁵⁹-Cr⁵¹ MIXTURES. S. Allan Lough and George J. Hertsch (Francis Delafield Hosp., New York). Nucleonics 13, No. 7, 66-7(1955) July.

The method for estimating Fe⁵⁹-Cr⁵¹ mixtures in blood samples developed at Francis Delafield Hospital is described. The instrumental set-up is composed of a scintillation well, linear amplifier, and discriminator. (D.E.B.)

7462

A DIRECT MEASUREMENT OF THE ENERGY LOCALLY ABSORBED FROM A GAMMA-RAY BEAM. H. E. Johns, J. P. Bernier, and D. V. Cormack (Univ. of Saskatchewan and Saskatoon Cancer Clinic, Canada). Nature 176, 560(1955) Sept. 17.

A radiation calorimeter capable of measuring temperature changes of 10^{-3} deg C with an accuracy of better than 1% was developed for a direct measurement of the energy absorbed from a γ beam. The sensitive part of the instrument consists of a cylinder (2 cm. in diameter, 2 cm. in length) a given material in which are imbedded a thermistor and heating coil. The cylinder is suspended in an evacuated and aluminized glass vessel placed in a tank of water, the temperature of which is controlled. An identical dummy cylinder is suspended in another evacuated vessel but does not receive radiation. The thermistors are connected to the opposite arms of a d-c Wheatstone bridge. A change in temperature of one of the cylinders produces an unbalanced voltage which is amplified and recorded on a self-balancing potentiometer. Results are presented from measurements on C and Al cylinders exposed to a Co⁶⁰ 1000-c beam. (L.M.T.)

7463

INSTABILITY OF PHOTOMULTIPLIERS. L. P. de Valence (Royal Cancer Hospital, London). Brit. J. Appl. Phys. 6, 311-13(1955) Sept.

A phenomenon of dark current instability in specified types of electrostatically focused photomultiplier tubes is described. Particular attention is drawn to the variation with glass envelope potential of dark current fluctuation under fixed circuit constant conditions. The degree of instability does not appear to be related to the relative photometric sensitivity on the tube. A possible explanation of the phenomenon on the basis of electron defocusing is suggested and a satisfactory method of eliminating the disturbance is described. (auth)

7464

ABSOLUTE CALIBRATION OF A COBALT-60 GAMMA-RAY BEAM. S. Genna and J. S. Laughlin (Sloan-Kettering Inst., New York). Radiology **65**, 394-407(1955) Sept.

A calorimetric method of determining the quantity of radiation (ergs/cm²) in a beam of radiation with precision is described. The application of this method to the gamma ray beam from a Co⁶⁰ source is reported with the result of $3,370 \pm 130$ ergs/cm² per roentgen where the roentgen measurement is based on the calibration of a secondary standard at the National Bureau of Standards. It is shown that theoretically, under these conditions, the roentgen is expected to correspond to a quantity of radiation of 3,250 ergs/cm² per roentgen. The design and operation of a precision extrapolation chamber are presented. The extrapolation chamber was employed to determine that in an air cavity imbedded at a depth of 0.726 gm/cm² in polystyrene, the ionization density is 0.96 esu/cm³ per roentgen in air. The utilization of the total degraded electron spectrum in the interpretation of absorbed dose from cavity ionization measurements is illustrated. For an air cavity in polystyrene the result is 98.8 ergs/gm per esu/cm³. The method of combining the calorimetric determination of quantity of radiation with a depth dose curve to obtain the absorbed dose is illustrated. The result for polystyrene expressed per unit cavity ionization density is 100.1 ergs/gm per esu/cm³. (auth)

7465

ON A DEVICE FOR TWO CHANNEL ELECTRONIC COUNTING PERMITTING DETECTION OF PAIRS IN A BACKGROUND OF PARASITIC PARTICLES. APPLICATION TO THE MONOPOLAR RAY OF O¹⁸. Serge Gorodetzky, Raymond Armbruster, Pierre Chevallier, Andre Gallmann, and Robert Manquenouille. Compt. rend. **241**, 482-3(1955) Aug. 1. (In French)

A block diagram is given for a coincidence circuit permitting the detection of electron pairs. The circuit was used to study the pairs from the monopolar ray of O¹⁸, and the resultant spectrum is shown. Results show that the circuit has a 14% resolution. (B.J.H.)

7466

CALCULATION OF THE ACTUAL THICKNESS OF EMULSION FILMS DURING INVESTIGATION OF NUCLEAR PROCESSES BY THE USE OF PHOTOGRAPHIC METHODS. M. M. Agrest. Zhur. Eksptl'. i Teoret. Fiz. **29**, 249-51(1955) Aug. (In Russian)

7467

INVESTIGATION OF THE REGION OF PARTIAL PRESSURES IN DIFFUSION-CONDENSATION CHAMBERS. V. K. Lyapidevskii (Moscow Engineering Physics Inst.). Zhur. Eksptl'. i Teoret. Fiz. **29**, 263-4(1955) Aug. (In Russian)

7468

ATOMIC RADIATION DETECTION AND MEASUREMENT. Harold S. Renne. Indianapolis, Howard W. Sams and Co., Inc., 1955. 198p. \$3.00

Information on atomic structure and atomic radiation and its effects is briefly reviewed. The equipment and techniques used in detecting and measuring radiation are discussed in some detail. Commercial Geiger counters, scintillation counters, home-built counters, and dosimeters are discussed in separate chapters which include a number of illustrations and circuit diagrams. Some applications of nuclear science are briefly touched upon, and information is presented on how radiation detection and measuring equipment is employed

in industry, civil defense, and prospecting. Appendices include directories of manufacturers and products and a bibliography. The book was written to be understandable to anyone with the equivalent of a high school general science course. (M.P.G.)

7469

AN AUTOMATIC SAMPLE CHANGER FOR RADIOMETRIC WORK. J. Rydberg (Research Inst. of National Defence, Sundbyberg, Sweden). J. Sci. Instr. **32**, 343-5(1955) Sept.

A simple, self-contained, automatic sample changer has been constructed, which can be used together with all common types of radioactivity pulse counters. The construction permits a simple exchange of the detector (for either α , β or γ counting) and allows repeated measurements for a predetermined time (1 sec to 10 days) or predetermined count (N to $10^5 N$, where N is the scaling factor) for up to 24 different samples. Data for absorption curves as well as back-scattering curves can be obtained automatically. (auth)

MESONS**7470 AEC-tr-2235**

PHOTOPRODUCTION OF π^0 MESONS FROM DEUTERIUM. A. S. Belousov, A. V. Kutsenko, and E. I. Tamm. Translated by V. N. Rimsky-Korsakoff from Doklady Akad. Nauk S.S.S.R. **102**, 921-3(1955). 9p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-6742.

7471

CORRELATION BETWEEN POSITIVE AND NEGATIVE FAST π MESONS. PRODUCED IN NUCLEAR SPLITTING. A. V. Khrimyan (Physics Inst., Academy of Sciences, Armenian S. S. R.). Doklady Akad. Nauk S. S. R. **103**, 229-32(1955) July 11. (In Russian)

7472

INTERACTION OF NEGATIVE π MESONS WITH BERYLLIUM, CARBON, AND OXYGEN NUCLEI IN THE ENERGY INTERVAL FROM 140 to 400 MEV. A. E. Ignatenko, A. I. Mukhin, E. B. Ozerov, and B. M. Pontecorvo (Inst. of Nuclear Problems). Doklady Akad. Nauk S.S.S.R. **103**, 395-7(1955) July 21. (In Russian)

7473

ON YIELDS OF FISSION AND STAR FORMATION FROM CAPTURE OF π^- MESONS BY U, Bi, AND W NUCLEI. N. A. Perfilov, O. V. Lozhkin, and V. P. Shamov (Khlopin Radium Inst.). Doklady Akad. Nauk S.S.S.R. **103**, 417-19(1955) July 21. (In Russian)

7474

β DECAY OF K-MESONS AND THE CLASSIFICATION OF K-MESON DECAYS. M. F. Kaplon, J. Klarmann, and G. Yekutieli (Univ. of Rochester, N. Y.). Phys. Rev. **99**, 1528-33(1955) Sept. 1.

Three well-identified cases of K-electron decay have been observed at Rochester. The secondary electrons range in energy from 20 to 261 Mev showing that the decay involves at least 3 particles. The available data on K meson decays observed in nuclear emulsion is analyzed from the point of view of asking how many of the secondaries are consistent with the assumption that they are μ mesons from the $K_{\mu 3}$ decay or electrons from the K_{e3} decay. It is found that an appreciable fraction ($\sim 1/4$ to $1/2$) of the observed decays are consistent with this assignment. The observed branching

ratio is consistent with that deduced from a Fermi interaction, but the lifetime predicted on the basis of a universal Fermi interaction seems shorter than that suggested by the observations in emulsion. It is concluded that the existing data on K mesons are consistent with the assumption that there exists at least five separate decay schemes and that it is possible for each case to consider the parent K meson as having integral spin. (auth)

7475

INTERACTION BETWEEN K-PARTICLES AND NUCLEONS. A. Pais and R. Serber (Columbia Univ., New York). *Phys. Rev.* **99**, 1551-5(1955) Sept. 1.

Some consequences of the strong interactions between K particles and nucleons are discussed. A connection is noted between the associated production mechanism and spatial exchange characteristics of K-nucleon scattering. (The same is true for Λ^0 -nucleon scattering.) The K-nucleon interactions may possibly lead to bound states of K particles in nuclear matter ("K-fragments"). If a θ^0 fragment exists, its decay modes are 2-, 1-, or 0-mesonic. It is estimated that the former two modes would have comparable probabilities, while the last one is less probable by a factor ~ 0.005 if the spin of the θ^0 is zero, or by a factor ~ 0.05 if the spin is 1. The results may have bearing on the interpretation of fragments with energy release larger than corresponds to a bound Λ^0 . (auth)

7476

DISINTEGRATION OF HYPERFRAGMENTS. W. F. Fry, J. Schneps, and M. S. Swami (Univ. of Wisconsin, Madison). *Phys. Rev.* **99**, 1561-73(1955) Sept. 1.

A systematic search has been made for events which appear to be due to the disintegration of a hyperfragment; that is, a nuclear fragment which contains a bound unstable particle. A total of 20,000 3-Bev proton stars and 500 1.5-Bev π^- -meson stars from the Brookhaven Cosmotron were studied as well as 9000 cosmic-ray stars. Twenty-one events which are interpreted as hyperfragments were found in the proton plates, seven in the cosmic-ray plates and one in the π -meson plates. Of the 29 disintegrations, a π meson was ejected in only two cases and a K meson in one event. In the remaining 26 disintegrations, only nuclear particles were emitted. The charge and energy distributions, as well as the angular distribution of the hyperfragments, have been measured. In four cases the energetics of the decay strongly indicate that the bound unstable particle was a Λ^0 particle. The binding of the Λ^0 particle was measured in these cases. In two additional cases the minimum energy release was significantly greater than the decay energy of a Λ^0 particle but possibly consistent with the decay energy of a charged hyperon. In one case a negative K meson was ejected from a secondary star. It is impossible to determine whether this secondary star was due to a fragment disintegration or the nuclear capture of a stopped particle. This event cannot be explained in terms of established unstable particles. (auth)

7477

ELECTRONIC DETECTION OF HEAVY MESONS. Kenneth W. Robinson (Princeton Univ., N. J.). *Phys. Rev.* **99**, 1606-7(1955) Sept. 1.

Scintillation and Cherenkov counters and fast electronic circuitry were used to detect the decay of mesons produced by cosmic rays. Descriptions and diagrams of the equipment are given. Results, as regards lifetimes and rates of these particles, are in general agreement with cloud chamber and emulsion results. (B.J.H.)

7478

MASS MEASUREMENTS OF PARTICLES AND EXISTENCE OF 1450 m_e MESONS. A. Husain, C. J. D. Jarvis, and E. Pickup (National Research Council of Canada, Ottawa). *Phys. Rev.* **99**, 1612-13(1955) Sept. 1.

Measurements made on fast particles from stars in nuclear emulsions show no evidence for the existence of a group of mesons with mass 1450 m_e . Results show that the particles in the stars are pions, K mesons, protons, deuterons and tritons. (B.J.H.)

7479

MEAN LIFETIME OF POSITIVE K MESONS. E. L. Iloff, W. W. Chupp, Gerson Goldhaber, S. Goldhaber, and J. E. Lannutti (Univ. of California, Berkeley). *Phys. Rev.* **99**, 1617-18(1955) Sept. 1.

The decay of artificially produced K^+ mesons was observed in flight in nuclear emulsion. These measurements gave a mean lifetime for K^+ mesons of $\tau_K = 1.01 \pm_{0.21}^{0.33} \times 10^{-8}$ sec. (B.J.H.)

7480

π^- -PROTON INTERACTIONS AT 4.5 BEV. George Maench, Wilson M. Powell, George Saphir, and Robert W. Wright (Univ. of California, Berkeley). *Phys. Rev.* **99**, 1619-20(1955) Sept. 1.

Interactions of π^- mesons and protons at 4.5 Bev were studied in a hydrogen-filled diffusion cloud chamber. The relative frequency of various interactions is summarized, showing that most interactions are 2-prong inelastic, 4-prong, or elastic (diffraction). (B.J.H.)

7481

METHOD OF CUT-OFF FIELD EQUATIONS AND ITS APPLICATION TO SCATTERING OF MESONS BY NUCLEONS. V. P. Silin, I. E. Tamm, and V. Ya. Fainberg (Lebedev Physics Inst.). *Zhur. Eksptl'. i Teoret. Fiz.* **29**, 6-19(1955) July. (In Russian)

7482

MULTIPLE PRODUCTION OF PARTICLES BY COLLISION OF HIGH-ENERGY NUCLEONS WITH NUCLEI. S. Z. Belen'ki and G. A. Milekhin (Lebedev Physics Inst. and Moscow State Univ.). *Zhur. Eksptl'. i Teoret. Fiz.* **29**, 20- (1955) July. (In Russian)

7483

ON THE THEORY OF NUCLEONS. D. I. Blokhintsev. (Moscow State Univ.). *Zhur. Eksptl'. i Teoret. Fiz.* **29**, 33-6(1955) July. (In Russian)

The hypothesis of indirect interaction of π mesons and nucleons is discussed. (G.Y.)

7484

TOWARD A THEORY OF Λ^0 PARTICLES. P. S. Isaev and M. A. Markov (Lebedev Physics Inst.). *Zhur. Eksptl'. i Teoret. Fiz.* **29**, 111-14(1955) July. (In Russian)

7485

ON PROCESSES OF PRODUCTION OF HEAVY MESONS AND V_1^0 PARTICLES. B. M. Pontecorvo (Inst. of Nuclear Problems). *Zhur. Eksptl'. i Teoret. Fiz.* **29**, 140-6(1955) Aug. (In Russian)

7486

STATISTICS OF SYSTEMS WITH CONSERVATION OF CHARGE AND ITS APPLICATION TO THE THEORY OF MULTIPLE PRODUCTION. V. B. Magalinski and Ya. P. Terletski (Moscow State Univ.). *Zhur. Eksptl'. i Teoret. Fiz.* **29**, 151-7(1955) Aug. (In Russian)

7487
REMSSSTRAHLUNG FROM COLLISIONS OF π MESONS WITH NUCLEONS. V. G. Solov'ev (Inst. of Nuclear Problems Problems). *Zhur. Eksptl'. i Teoret. Fiz.* 29, 242-5(1955) Aug. (In Russian)

7488
NUCLEAR CAPTURE OF A NEGATIVE HEAVY MESON. G. A. Zamchalova, V. I. Karpova, and M. O. Tret'yakova (Lebedev Physics Inst.). *Zhur. Eksptl'. i Teoret. Fiz.* 29, 45 + insert(1955) Aug. (In Russian)

A microphotograph of an event in nuclear emulsion exposed in the stratosphere is presented and interpreted as the capture of a heavy meson by a nucleus to yield a π meson with ~ 30 Mev energy. (G.Y.)

7489
ON THE ROLE OF ISOBARIC STATES OF NUCLEONS DURING MESON PRODUCTION. A. I. Nikishov. *Zhur. Eksptl'. i Teoret. Fiz.* 29, 246(1955) Aug. (In Russian)

7490
DETERMINATION OF THE MASSES OF HEAVY MESONS AND HYPERONS BY PHOTOMETRY OF THE TRACKS IN NUCLEAR EMULSIONS. L. van Rossum. *Ann. phys.* 10, 43-92(1955) July-Aug. (In French)

A general discussion is given on the identification of heavy mesons and hyperons. The accuracy of the "ionization-range" method is discussed in detail. The photometry of nuclear tracks is also discussed, with special emphasis on the photometry of tracks containing 50 to 300 grains per 100 microns. The apparatus described was used to measure the masses of particles in tracks registered by exposure of nuclear emulsions to cosmic radiation at high altitudes. Particular tracks are discussed, and the data are summarized. Values of mass obtained for slow K mesons vary from $800 m_e$ to $1400 m_e$ with a maximum between $1000 m_e$ and $1100 m_e$. (B.J.H.)

METEOROLOGY

7491 AECU-3054
 Sandia Corp., Albuquerque, N. Mex.]

OSONOSPHERE OBSERVATIONS FROM PROPAGATION OF ATOMIC BLAST WAVES. Jack W. Reed. June 1, 1955. 1p. Contract [AT-(29-1)-789]. (TM-86-55-51)

Observations of refracted sound waves from atomic tests at the Nevada and Pacific Proving Grounds are evaluated to show temperature and winds in the ozonosphere. Results indicate ozonosphere temperatures 50°C higher than temperatures adopted by the Rocket Panel. A simplified method of making these interpretations is presented to reduce the computation work load normally associated with atmospheric sound studies. (auth)

7492 AECU-3066
 Weather Bureau, Washington, D. C.
METEOROLOGY AND ATOMIC ENERGY. July 1955. 82p.

The application of meteorology to the air-pollution problem of the atomic industry is discussed. Methods and suggestions for the collection, analysis, and use of meteorological data are included. Topics discussed include: meteorology in site operations, meteorological fundamentals for air pollution studies, atmospheric diffusion theories, behavior of stack effluents, behavior of explosion debris clouds, fall-out from airborne clouds,

radioactive cloud dosage calculations, graphical solutions to atmospheric diffusion problems, reactor hazard analyses, meteorological equipment and records, and climatological data for site selection and planning. Selected equations, parameters, and conversion factors are included. (152 references.) (C.H.)

MOLECULAR PROPERTIES

7493 CRT-609

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

TRANSFORMATION COEFFICIENTS BETWEEN LS AND JJ COUPLING. J. M. Kennedy and M. J. Cliff. Aug. 1955. 39p. (AECL-224)

The wave function of two particles in LS coupling may be expressed in terms of the wave functions in jj coupling by

$$\psi(l_1 l_2 L, s_1 s_2 S, JM) = \sum_{j_1 j_2} A \begin{pmatrix} l_1 & s_1 & j_1 \\ l_2 & s_2 & j_2 \\ L & S & J \end{pmatrix} \psi(l_1 s_1 j_1, l_2 s_2 j_2, JM)$$

or by the inverse relation

$$\psi(l_1 s_1 j_1, l_2 s_2 j_2, JM) = \sum_{LS} A \begin{pmatrix} l_1 & s_1 & j_1 \\ l_2 & s_2 & j_2 \\ L & S & J \end{pmatrix} \psi(l_1 l_2 L, s_1 s_2 S, JM).$$

In these equations l_1 and l_2 are orbital angular momenta whose resultant is L , s_1 and s_2 are spins whose resultant is S , j_1 and j_2 are the total angular momenta of the individual particles, and J is the resultant angular momentum of the complete system. The expansion coefficients A are independent of M , the z -component of J . In atomic and nuclear spectroscopy $s_1 = s_2 = \frac{1}{2}$. The tables in this report give the resulting coefficients

$$A \begin{pmatrix} l_1 & \frac{1}{2} & j_1 \\ l_2 & \frac{1}{2} & j_2 \\ L & S & J \end{pmatrix}$$

for values of l_1 and l_2 not exceeding 5, and for all values of the remaining parameters. The coefficients are the square roots of rational fractions, and are given to 8 places of decimals and exactly in factored form. (auth)

7494 NP-5756

New York. Univ.

FLUORESCENCE AND CONDUCTIVITY PHENOMENA.

Quarterly Progress Report No. 8 for November, December [1954], January [1955]. Physics Dept. Hartmut Kallmann. July 1955. 81p. Project [196B]. Contract DA-36-039-sc-42626.

Progress is reported in the study of α -particle induced fluorescence, radiative and non-radiative transitions induced by infrared and beta irradiations, and light emission as a function of time in various phosphors. Experimental results in fluorescence stimulation and quenching, light emission after β -excitation, and dark decay under various temperature conditions are included. Also presented is a review of experimental procedures, on evaluation of emission during excitation, a determination of the duration of excitation, and a discussion of results on individual phosphors. (For previous report in series see NP-5955.) (D.E.B.)

7495 TT-540

SENSITIZED PHOSPHORESCENCE OF ORGANIC MOLECULES AT LOW TEMPERATURES. (Sensibilizovannia Fosforesentsiia Organicheskikh Molekul Pri Nizkoi Temperature). V. L. Ermolaev and A. N. Terenin. Translated by G. Belkov from *Akad. Nauk S.S.S.R., Pamyati S. I. Vavilova*, 137-46(1952). 16p.

An attempt to find proof of the transfer of excitation energy in concentrated solutions by energy transfer from one molecule to another is made by observation of secondary luminescence of molecules of another type in a mixture where the primary excited fluorescent molecules undergo fluorescence quenching. In particular, sensitized fluorescence of mixtures and solutions of fluorescent aromatic molecules is studied. Benzaldehyde molecules were chosen as one of the participants in energy transfer. Sensitized phosphorescence was found in naphthalene + benzaldehyde. Similar effects were observed in an ethanol solution and in other pairs of substances. (B.J.H.)

7496

COLLISIONS BETWEEN NON-SPHERICAL MOLECULES. I. MOLECULAR COLLISIONS IN HYDROGEN GAS AT LOWER TEMPERATURES. Kazuo Takayanagi and Kimio Ohno (Saitama Univ., Urawa, Japan and Univ. of Tokyo). *Progr. Theoret. Phys. (Japan)* **13**, 243-59(1955) Mar.

Collisions between an atom and a diatomic molecule are theoretically investigated. The detailed calculations are carried out in the special case of hydrogen gas at lower temperatures in order to interpret the observed relation between the viscosity of the gas and the para-ortho concentration ratio. It is found that, by improving the shape of the intermolecular potential, one can avoid the greater part of the discrepancy between the experimental fact and the result of an older theory. However, quantitative explanation of the relation requires more detailed and exhaustive calculations. (auth)

7497

NUCLEAR QUADRUPOLE SPECTRUM OF 1,2,4,5-TETRACHLOROBENZENE. André Monfils. *Compt. rend.* **241**, 561-2(1955) Aug. 8. (In French)

The nuclear quadrupole spectrum of 1,2,4,5-tetrachlorobenzene corresponding to Cl^{35} was obtained with a radioelectric spectrograph at various temperatures. Data are presented in tabular and graphical form. A discontinuity appears at 188°K indicating the existence of a phase transition at that point. (B.J.H.)

NEUTRONS**7498**

ABSOLUTE CALIBRATION OF THE NATIONAL BUREAU OF STANDARDS PHOTONEUTRON STANDARD. I. J. A. De Juren, D. W. Padgett, and L. F. Curtiss. *J. Research Natl. Bur. Standards* **55**, 63-9(1955) Aug.

The absolute emission rate of neutrons from the National Bureau of Standards radium-beryllium photoneutron standard source has been determined from the volume integral of the neutron absorption rate in water. Thin indium and manganese foils were employed to measure the thermal-neutron density as a function of distance from the source. The foil activities were converted to neutron densities by calibration of the foils in a reference thermal-neutron flux previously calibrated with boron films. A motor driven mechanical integrator,

which moves foils radially from the source at a rate that takes into account the increase in area with distance from the source and the decay of the foils, provided over 80% of the volume integral. A value of $1.26_1 \times 10^6$ neutrons per second was determined for the emission rate of the photoneutron standard, with an estimated standard error of 3%. (auth)

7499

THERMAL INELASTIC SCATTERING OF COLD NEUTRON IN POLYCRYSTALLINE SOLIDS. L. S. Kothari and K. S. Singwi (Tata Inst. of Fundamental Research, Bombay, India). *Proc. Roy. Soc. (London)* **A231**, 293-307(1955) Sept. 6.

A general theory of the influence of thermal motion of the scattering of slow neutrons in polycrystals is discussed. Unlike Weinstock's earlier treatment of the same problem, temperature displacements of the lattice points are discussed as a sum of emission and absorption operators. This alternative approach simplifies the calculation of the transition probability to a considerable extent and provides a simple proof of the Debye-Waller factor. The theory is also generalized to the case of multi-phonon processes. General expressions for both the incoherent and coherent cross sections, corresponding to an 'l' phonon process, are derived. The latter, hitherto not treated rigorously, is examined in detail. It is shown that it can be expressed as a sum of two terms, of which the main term, apart from a constant, is identical with the expression for the incoherent part and the other is a correction term. Both terms are put in 'Placzek form, and for cold neutrons explicit expressions are obtained for the cases: (i) $M \gg 1$, and $T/\Theta \geq 1$, and (ii) $M \sim 10$ and $T/\Theta \geq 0.5$. Numerical results for magnesium, aluminum, iron, lead and beryllium are discussed and compared with experiment. The agreement is found to be satisfactory. (auth)

NUCLEAR PHYSICS**7500**

FORMULA FOR DIFFERENTIAL CROSS SECTION IN NUCLEON-NUCLEON SCATTERING. Masahiko Matsumoto (Siga Univ., Otsu, Japan). *Progr. Theoret. Phys. (Japan)* **13**, 329-34(1955) Mar.

The appreciable phase shift of orbital angular momentum $L > 1$ at high energy nucleon-nucleon scattering is attributed to non-central tensor forces in the coupling between 3S_1 , 1D_2 , 3P_2 , and 3F_2 waves. A formula for the differential cross section taking into account the coupling due to tensor force in the total angular momentum is presented. (D.E.B.)

7501

RELATION BETWEEN OSCILLATIONS OF THE NUCLEAR SURFACE AND SINGLE NUCLEON EXCITATION. A. S. Davydov (Moscow State Univ.). *Zhur. Ekspit'. i Teoret. Fiz.* **29**, 75-88(1955) July. (In Russian)

NUCLEAR PROPERTIES**7502 NP-5760**

California. Univ., Berkeley. BOUND STATES AND LOW ENERGY NEUTRON SCATTERING. Technical Report No. 2. R. D. Lawson. [1955]. 9p. Contract DA-04-200-ord-171, T. O. 11.

Solutions are given for the S states of the potential $V(r) = -V_0/(1 + e^{\alpha(r-a)})$. These are used to calculate the position of

the giant S wave neutron resonances at low (zero) energy and the bound states of the potential. If one chooses $V_0 = 41$ Mev, $\alpha = 2 \times 10^{13} \text{ cm}^{-1}$ and $a = 1.35 \text{ A}^{1/3}$, the potential binds the right number of particles. S wave maxima in the elastic scattering cross sections then occur at $A = 13, 64$, and 183. The experimental curves show a rise in the total scattering cross section in the region $A \sim 60$ and 180 for small neutron energies. (auth)

7503

PROTON MAGNETIC RESONANCE IN POLYAMIDES. W. P. Slichter (Bell Telephone Labs., Inc., Murray Hill, N. J.). *J. Appl. Phys.* **26**, 1099-1103(1955) Sept.

The proton magnetic resonance absorption has been observed in several linear polyamides from 77°K to 400°K. The absorption line narrows gradually with increasing temperature up to about 280°K. A marked decrease in line width with increasing temperature occurs over a span of 20 or 30 degrees within the range of 280 to 400°K, and is presumed to result from the onset of rotation of chain segments. In a series of polyamides possessing an even number of C atoms between polar groups, this transition occurs at a lower temperature as the hydrocarbon portions are made longer (polydecamethylene octadecanediamide compared to polyhexamethylene adipamide). In the copolymer polyhexamethylene adipamide-sebacamide, the transition region is at a lower temperature than in the pure adipamide or pure sebacamide. The x-ray diffraction studies on polyamide fibers show that the chain packing becomes more symmetrical over these same temperatures. The resonance results are interpreted in terms of simple models. (auth)

7504

ON THE INTERPRETATION OF NUCLEAR RESONANCE FLUORESCENCE EXPERIMENTS. J. David Jackson (McGill Univ., Montreal, Quebec, Canada). *Can. J. Phys.* **33**, 575-6(1955) Sept.

Modifications are made in the interpretation of nuclear resonance fluorescence in the presence of appreciable branching and/or internal conversion. The basic resonance formula for this case is also given. (B.J.H.)

7505

CIRCULAR POLARIZATION OF GAMMA-RAYS FOLLOWING POLARIZED NEUTRON CAPTURE. Georg Trumpp (Joint Establishment for Nuclear Energy Research, Kjeller, Norway). *Nature* **176**, 507-8(1955) Sept. 10.

An experiment was carried out in order to verify that the capture of polarized thermal neutrons may result in the emission of circularly polarized γ rays. It can be shown that neither linear polarization nor anisotropic distribution of the γ radiation can result from the reaction. For total neutron polarization, the degree of left circular polarization of the γ -rays emitted in the direction of the neutron spin is shown. (auth)

7506

CONTRIBUTION TO THE STUDY OF THE SHAPES AND AMPLITUDES OF THE LINES IN NUCLEAR RESONANCES. Yves Ayant. *Ann. phys.* **10**, 487-532(1955) July-Aug. (In French)

Complete discussions are given of the roles of spin-orbit and spin-spin interaction in quadrupole resonance. The theory of the effect of semi-rotations on quadrupole resonance is also discussed as in the relaxation time of nuclear magnetic resonance. Some of problems are treated by the method of correlation functions of a quantum variable, but since the

theory of this method will be the subject of a future article, only some applications are given in detail. (B.J.H.)

7507

STUDY OF NUCLEAR QUADRUPOLE RESONANCE. DETECTION AND APPLICATIONS. M. Buyle-Bodin. *Ann. phys.* **10**, 533-83(1955) July-Aug. (In French)

A complete survey is given of the detection and applications of nuclear quadrupole resonance. Experimental procedures discussed include surveys of the problems involved, the super reaction receiver in Hertzian spectroscopy and the absorption spectrograph. Complete diagrams and discussions of equipment are given. Some of the experimental results discussed include the influence of a magnetic field on nuclear quadrupole resonance and the study of semi-rotations in the solid state. (B.J.H.)

7508

GAMMA-GAMMA DIRECTIONAL CORRELATION IN Pt^{192} . H. W. Taylor and R. W. Pringle (Univ. of Manitoba, Winnipeg, Canada). *Phys. Rev.* **99**, 1345-6(1955) Sept. 1.

Spins have been tentatively assigned to the first five states of Pt^{192} , the proposed spin sequence being 0, 2, 2, 3 (4), 4. The 296- and 468-kev transitions appear to be dipole-quadrupole mixtures. For the former, the percentage quadrupole radiation is 97.5% and for the latter, 5.8%. (auth)

7509

LOWEST STATE OF SURFACE OSCILLATION OF O^{16} AT 14.7 MEV. D. H. Wilkinson (Brookhaven National Lab., Upton, N. Y.). *Phys. Rev.* **99**, 1347-51(1955) Sept. 1.

The strongly resonant absorption of gamma rays by O^{16} that is observed at an energy of 14.7 Mev in the reaction $\text{O}^{16}(\gamma, p)\text{N}^{15}$ is discussed. It is shown from consideration of the integrated cross section of this resonance and from the angular distribution of the photoprotons that the absorption is most probably electric quadrupole in character. It is suggested that the state at 14.7 Mev may be the lowest state of surface oscillation of O^{16} . This hypothesis gives the correct angular distribution for the photoprotons and requires the values $C_2 = 56$ Mev, $B_2 = 1.8 \times 10^{-49} \text{ g cm}^2$ for the parameters describing the surface oscillation; these parameters are 2.0 times bigger and 2.3 times smaller than expectation based on the value of the nuclear surface tension and classical hydrodynamics, respectively; these departures are in the sense naively expected for a closed-shell nucleus. (auth)

7510

INTERMEDIATE COUPLING SHELL MODEL FOR Be^9 . J. B. French, E. C. Halbert, and Sudhir P. Pandya (Univ. of Rochester, N. Y.). *Phys. Rev.* **99**, 1387-92(1955) Sept. 1.

Energy levels, nuclear moments, and relative deuteron reaction cross sections are calculated for Be^9 using a Rosenfeld central and a one-particle spin-orbit interaction. The level structure and the magnetic dipole moment are sensitive functions of the magnitude of the spin-orbit interaction. The best fit to the experimentally found spectrum is given at a value $a/K = 1.7$ for the intermediate coupling parameter of Inglis and at $K = 1.33$ Mev for the Slater integral parameter. The 2.43-Mev state, in particular, is predicted to be $5/2^-$. The observed magnetic moment is fitted either in extreme jj coupling or once again at $a/K = 1.7$. Certain relative cross sections in the reactions $\text{B}^{10}(n, d)\text{Be}^9$ and $\text{B}^{10}(p, d)\text{Be}^9$ are calculated and found to be in agreement with experiment. (auth)

7511

ELASTIC SCATTERING OF ALPHA PARTICLES AND

DEUTERONS BY COMPLEX NUCLEI. C. E. Porter (Brookhaven National Lab., Upton, N. Y.). *Phys. Rev.* **99**, 1400-5(1955) Sept. 1.

The elastic scattering of alpha particles and deuterons by heavy nuclei is calculated approximately using a classical approach. Rough agreement with the available alpha particle data is obtained with a ratio of interaction radius to mean free path near the center of the nucleus of about 3 to 4 and a $(1/e)$ edge-diffuseness distance of 1×10^{-13} cm. Interpretation of the available deuteron data is somewhat uncertain at present. (auth)

7512

ELASTIC SCATTERING OF PROTONS BY He^3 AND T. R. M. Frank and J. L. Gammel (Los Alamos Scientific Lab., N. Mex.). *Phys. Rev.* **99**, 1406-10(1955) Sept. 1.

A phase shift analysis is made of the p- He^3 and p-T elastic scattering data using theoretical predictions wherever possible to reduce the number of parameters. It is pleasing that the resulting phase shifts all have their expected signs and reasonable magnitudes and satisfy relations connecting the p-T and p- He^3 phase shifts. The analysis was also made without using the theoretical conditions, and all the solutions found are presented. However, these other solutions are rejected. The phase shifts accepted as correct are discussed in terms of resonances. (auth)

7513

PARTICLE BINDING ENERGIES AND THE DIFFUSENESS OF THE NUCLEAR BOUNDARY. Alex E. S. Green (Florida State Univ., Tallahassee). *Phys. Rev.* **99**, 1410-15(1955) Sept. 1.

The approximate eigenvalues for a spherical well with an exponentially diffuse boundary and with spin-orbit splittings are applied to the study of particle binding energies. If the A-value locations of the low velocity 3s and 4s maxima in the neutron cross section surface are taken at $A = 55$ and $A = 150$, the general trends of experimental binding energies and experimental radii sharply restrict the degrees of diffuseness that can be allowed. It would appear that the general trends of both proton and neutron binding energies as well as their discontinuities can be accounted for if a diffuseness parameter (i.e., tail length to e^{-1} point divided by inner radius) is chosen which drifts gradually from $\delta = 0.3$ for light nuclei to $\delta = 0.2$ for heavy nuclei. The diffuseness parameter needed goes to somewhat smaller values ($\delta \sim 0.13$) if the critical 4s A-value is taken at 170. For heavy elements the diffuseness of the potential well obtained here is comparable to the diffuseness of the nuclear charge distribution obtained in recent studies. (auth)

7514

NEUTRON-DEFICIENT ACTIVITIES OF TERBIUM. T. H. Handley and W. S. Lyon (Oak Ridge National Lab., Tenn.). *Phys. Rev.* **99**, 1415-17(1955) Sept. 1.

A survey was made of the neutron-deficient activities of terbium produced by proton bombardment of enriched isotopes of gadolinium. Half lives and mass assignments are made for Tb^{156} and Tb^{154} , and the limits of half-lives for Tb^{158} , Tb^{157} , and Tb^{155} are defined. Data were obtained on the gamma-ray spectrum of Tb^{156} . (auth)

7515

INTERACTIONS BETWEEN CONFIGURATIONS OF THREE NUCLEONS IN THE 1d, 2s SHELL. Martin G. Redlich (Univ. of Wisconsin, Madison). *Phys. Rev.* **99**, 1427-39(1955) Sept. 1.

Calculations for the nuclei with mass 19 were based on shell model with harmonic oscillator wave functions, central Gaussian interactions between the three outer nucleons, and a single-particle operator which leads to the energy differences between $1d_{3/2}$, $2s_{1/2}$, and $1d_{5/2}$ levels observed in O^{17} . Energy matrices for all configurations of the 1d, 2s shell were calculated. Wave functions of four nuclear states were obtained. They lead to the observed ft value for the allowed unfavored $\text{O}^{19} \beta^-$ transition, as well as for the favored $\text{Ne}^{19} \beta^+$ transition. Energy differences between $5/2^+$ and $1/2^+$ states of F^{19} and ground states of O^{19} and F^{19} are correctly given. Disagreement with the measured energy of the $1/2^+$ state of O^{19} and the magnetic moment of F^{19} , however, indicates that at least modifications of this model are necessary to obtain general agreement. (auth)

7516

INELASTIC NEUTRON SCATTERING IN F^{19} . Joan M. Freeman (Atomic Energy Research Establishment, Harwell, Berks, England). *Phys. Rev.* **99**, 1446-7(1955) Sept. 1.

The energies and yields of the γ rays following inelastic neutron scattering in F^{19} have been studied as a function of neutron bombarding energy up to 2.2 Mev. In this range four γ rays only, of energies 111 ± 1.5 kev, 196 ± 2 kev, 1.240 ± 0.015 Mev and 1.371 ± 0.016 Mev, have been found. The first two correspond to the first two excited states of F^{19} . The second pair of γ rays appear, from the threshold curves, to arise from F^{19} levels at 1.43 ± 0.03 and 1.55 ± 0.03 Mev respectively. The alternative of a 1.35-Mev level and the decay scheme are discussed. (auth)

7517

n-p SCATTERING AT 300 MEV. John De Pangher (Univ. of California, Berkeley). *Phys. Rev.* **99**, 1447-57(1955) Sept. 1 (cf. NSA 8-5738)

An investigation of the protons scattered by 300-Mev neutrons has been conducted with a Wilson cloud chamber filled with hydrogen at a gas pressure of ten atmospheres. The data obtained cover the range of angles 10° to 180° for the neutrons in the center-of-mass system. A striking deviation from symmetry appears in that backward scattering is considerably larger than forward scattering. The energy spectrum is presented for the neutrons that are produced in a $1\frac{3}{4}$ -in.-thick LiD target by 340-Mev proton. A few cases of meson production are noted. Also, there is presented experimental evidence for the radiative capture of high-energy neutrons in hydrogen. (auth)

7518

CHARGE INDEPENDENCE IN LIGHT HYPERFRAGMENTATION. R. H. Dalitz (Institute for Advanced Study, Princeton, N. J.). *Phys. Rev.* **99**, 1475-7(1955) Sept. 1.

The study of binding energies of light hyperfragments may provide a quantitative test of Gell-Mann's proposal to describe the Λ^0 -particle as an isotopic-spin singlet. Specific predictions are that ${}^1\text{H}^{4*}$ should exist with the same B_Λ as for ${}^2\text{He}^{4*}$, and that B_Λ for ${}^3\text{He}^{3*}$, if this exists, should not exceed B_Λ for ${}^1\text{H}^{3*}$. (auth)

7519

HIGH-ENERGY ELECTRON SCATTERING AND NUCLEAR STRUCTURE DETERMINATIONS. III. CARBON-12 NUCLEUS. Jerome H. Fregeau and Robert Hofstadter (Stanford Univ., Calif.). *Phys. Rev.* **99**, 1503-9(1955) Sept. 1.

The elastic scattering peak in C^{12} is accompanied by a number of additional peaks corresponding to inelastic scattering of electrons from the various excited levels of the

carbon nucleus. Three levels have been investigated by this method and correspond to the three known states at 4.43, 6.68, and 9.61 Mev. Angular distributions of the inelastically scattered electrons have been obtained as well as the angular distribution of the elastically scattered electrons. The angular distributions of the inelastic peaks fall off less steeply with angle than the elastic peak. By comparing the scattering from carbon with scattering from the proton, and using the theoretical value of the cross section of electrons scattered from the proton, it is possible to obtain "absolute" values for the elastic and inelastic scattering cross sections. From the elastic scattering curve, information about the size and charge distribution in the C^{12} nucleus may be derived. The charge distribution lies halfway between a Gaussian and a uniform model. The root mean square radius of the resultant charge distribution is $(240 \pm 0.25) \times 10^{-13}$ cm. (auth)

520

DEUTERON STRIPPING PROCESSES AT HIGH ENERGIES. J. J. Glauber (Harvard Univ., Cambridge, Mass.). *Phys. Rev.* **99**, 1515-16(1955) Sept. 1.

The processes which lead to the formation of stripped particle beams in encounters of high-energy deuterons with heavy nuclei are discussed. It is shown that a significant role is played by a previously unnoticed dissociation process arising from diffractive effects in which, from a classical standpoint, the particles suffer no collisions. (auth)

521

CLASSIFICATION OF THE FUNDAMENTAL PARTICLES. J. G. Sachs (Univ. of Wisconsin, Madison). *Phys. Rev.* **99**, 573-80(1955) Sept. 1.

The decay and production processes of the pions, K mesons, nucleons, and hyperons are classified in terms of selection rules for an integral quantum number, \underline{a} , called the "attribute," which is assigned a definite value for each particle and assumed to be additive when particles are combined. No attempt is made to relate the attribute to other physical properties of the particles. The scheme suggests relationships between processes which have yet to be observed such as the associated production of a cascade particle with two (positive or neutral) K mesons. When it is combined with the notion of isotopic spin (I) conservation, it suggests the existence of several new particles, the Σ^0 of Gell-Mann and Ishijima, a Ξ^0 and a neutral K meson differing in its properties from the θ^0 . Results of isotopic spin assignments suggest the rule (odd-even rule) that even- \underline{a} fermions have half integral I, odd- \underline{a} fermions have integral I, and conversely for the bosons. There are also implications concerning the interactions between various particles: the range of the potential binding the Λ^0 to a nucleon should be of the order of the K meson Compton wave length. The classification is extended to include electrons, neutrinos, and muons with the result that their attributes must be half-integral. In order to exclude certain unobserved processes, it is necessary to assume that the neutrino is the source of the weak (Fermi) interaction of fermions, in contrast to the action of the universal Fermi interaction. The existence of an antineutrino is strongly suggested. The $K_{\mu 3}$ and $K_{e 3}$ (considered as one particle) may be interpreted as a boson (κ) or fermion (κ). In the former case, the decay schemes $K^+ \rightarrow e^+ + \nu$, $K^0 \rightarrow 2\nu$, and $K^0 \rightarrow \pi + \mu + \nu$ are expected to occur. In the latter case, production of the κ through the decay process $K \rightarrow \kappa + \nu$ is suggested. Several unusual new events are classified in order to illustrate the method. A

table of thresholds for production of the various particles is included in an Appendix. No excuse is offered for the non-occurrence of π -e decay. (auth)

7522

ELASTIC SCATTERING OF 19-MEV ALPHA PARTICLES BY Al AND Cu. E. Bleuler and D. J. Tendam (Purdue Univ., Lafayette, Ind.). *Phys. Rev.* **99**, 1605-6(1955) Sept. 1.

Cyclotron α particles of 18.9 Mev were scattered from 0.0001-inch Al and Cu foils, and the scattered particles were detected with a NaI scintillation spectrometer. The ratios of the observed to Rutherford cross section are shown. Indications of diffraction effects appear in the data. (B.J.H.)

7523

ELASTIC SCATTERING OF 40-MEV ALPHA PARTICLES FROM Al. R. M. Eisberg, G. Igo, and H. E. Wegner (Brookhaven National Lab., Upton, N. Y.). *Phys. Rev.* **99**, 1606(1955) Sept. 1.

It is reported that the elastic scattering of 40-Mev α particles from Al shows a pronounced diffraction pattern. The angular distribution of the scattering is shown. (B.J.H.)

7524

FAST E2 TRANSITION PROBABILITIES FROM COULOMB EXCITATION. G. M. Temmer and N. P. Heydenburg (Carnegie Institution of Washington, D. C.). *Phys. Rev.* **99**, 1609-12(1955) Sept. 1.

A summary is presented of results on positions and lifetimes of excited states of nuclei in the region $Z = 60$ to 92 and $Z = 22$ to 48. The summary is confined to even-even nuclei and E2 Coulomb excitation. (B.J.H.)

7525

ROTATIONAL LEVELS IN THE BETA DECAY OF PROTACTINIUM ISOTOPES. Ong Ping Hok (Univ. of Amsterdam, Netherlands). *Phys. Rev.* **99**, 1613-14(1955) Sept. 1.

Beta-spectrometric measurements of Pa^{228} , Pa^{230} , Pa^{232} , and Pa^{234} in a 30-cm double-focusing magnetic β -ray spectrometer gave indications of rotational levels in the even-even daughter nuclides of U and Th. These results are tabulated. (B.J.H.)

7526

ELEMENTARY PARTICLES AS SELF-MAINTAINED EXCITATIONS. F. A. Kaempffer (Univ. of British Columbia, Vancouver, Canada). *Phys. Rev.* **99**, 1614-15(1955) Sept. 1.

It is suggested that an elementary particle can be thought of as a self-maintained excitation of a medium, described in terms of the usual electromagnetic potentials and a spinor field of vanishing mechanical mass. It is stated that such a conception would eliminate difficulties inherent in contemporary theories of elementary particles. (B.J.H.)

7527

CLASSIFICATION OF THE NUCLEONIC STATES IN DEFORMED NUCLEI. B. R. Mottelson and S. G. Nilsson (Univs. of Copenhagen and Lund, Denmark). *Phys. Rev.* **99**, 1615-17(1955) Sept. 1.

Classification of the nucleonic states in the deformed nuclei in the region $150 < A < 194$ is reported. From the ground-state configurations, equilibrium deformations are calculated. Spectra for protons for $Z = 50$ to $Z = 82$ and for neutrons for $N = 82$ to $N = 126$ as a function of nuclear deformation are given. The calculated ground-state equilibrium deformations are also compared to those deduced from the observed intrinsic quadrupole moments. (B.J.H.)

7528

PHOTONUCLEAR EFFECT. S. Rand (Univ. of California, Berkeley). *Phys. Rev.* **99**, 1620-1(1955) Sept. 1.

Using the Hamiltonian $H = (1/2M)p \cdot (1 - V/V_0)p + V$, where V is the nuclear potential and V_0 is a positive constant, calculations were made on photon absorption cross sections. The results are presented in tabular form. (B.J.H.)

7529

MAGNETIC MOMENT OF THE PROTON. D. J. Collington, A. N. Dells, J. H. Sanders, and K. C. Turberfield (Clarendon Lab., Oxford, England). *Phys. Rev.* **99**, 1622-3(1955) Sept. 1.

The magnetic moment of the proton was measured to be $\mu_p = 2.79281 \pm 0.00004$ nuclear magnetons. (B.J.H.)

NUCLEAR REACTORS**7530 BNL-1996**

Brookhaven National Lab., Upton, N. Y.

THE NUCLEAR REACTOR WITH A TRANSVERSE AIR GAP. J. Chernick and I. Kaplan. Aug. 24, 1954. Decl. November 29, 1954. 19p. Contract [AT-30-2-GEN-16].

Diffusion theory and transport theory approaches to the problem of a nuclear reactor with a transverse air gap are compared. It is suggested that the difference in results for thin gaps is due to the fact that diffusion theory does not adequately represent the flux distribution in the immediate vicinity of the gap. For mathematical convenience previous treatments of the gap problem have made use of fictitious image piles which exaggerate the neutron losses. The extent of the error is estimated by direct neutron leakage calculations. (auth)

7531

NEUTRON-FLUX DISTRIBUTION FROM A THERMAL-COLUMN FACE. Isabella Goldin Weinberg and E. Richard Cohen (North American Aviation, Inc., Downey, Calif.). *Nucleonics* **13**, No. 7, 25-7(1955) July.

A method is given for determining the flux distribution around the face of a thermal column. Isodose curves for a circular opening in a large thermal column face are calculated. (D.E.B.)

7532

DUAL CYCLE IMPROVES BOILING-WATER REACTORS. Samuel A. Untermeyer (General Electric Co., Schenectady, N. Y.). *Nucleonics* **13**, No. 7, 34-5(1955) July.

Power output of a simple direct-boiling reactor is limited due to density fluctuations in the moderator caused by boiling. The relatively low power densities, 10 kw/liter, available in large reactors under these conditions are not attractive for central station operation. To improve maximum power and load-demand performance, the use of a flask tank for feedwater subcooling is suggested. (D.E.B.)

7533

PREVENTING REACTIVITY LOSS CAUSED BY U PRECIPITATION IN A WATER BOILER. Clifford K. Beck (North Carolina State Coll., Raleigh). *Nucleonics* **13**, No. 7, 58-61(1955) July.

Reactivity loss in the Raleigh Research Reactor caused by the precipitation of the U fuel in the form of $UO_4 \cdot 2H_2O$ is reported. Reactivity was restored by the addition of $CuSO_4$ and $FeSO_4$ to the fuel solution. This is suggested as a method of preventing reactivity loss in homogeneous reactors. (D.E.B.)

7534

PUMPS FOR REACTOR COOLANTS. *Nucleonics* **13**, No. 7, 78-80(1955) July.

A tabulation of pumps for liquid nuclear reactor coolants has been prepared from a survey of pump manufacturers. Mechanical and electromagnetic pumps are listed, and suppliers and pump characteristics given. (D.E.B.)

7535

PRINCIPLES OF NUCLEAR REACTOR ENGINEERING. Samuel Glasstone. New York, D. Van Nostrand Co., Inc., 1955. 861p. \$7.95.

This book is presented to engineers and engineering students as an aid in meeting the demands of the entrance of nuclear technology into the American industrial pattern. To meet the demands of both reference and textbook use, the book was made as complete as possible. Chapters are devoted to nuclear reactions, reactor theory, reactor instrumentation, reactor control, reactor fuel processing, reactor materials, radiation protection, reactor shielding, thermal reactor systems, reactor design variables, and reactor descriptions. (D.E.B.)

NUCLEAR TRANSFORMATION**7536 NYO-6140**

Columbia Univ., New York.

SILVER FISSION INDUCED BY 388 MEV. PROTONS (thesis). Daniel H. Greenberg. Apr. 19, 1954. 85p. Contract AT(30-1)-1019. (CU-16-54-AEC-1019-Chem.)

High purity silver foil was irradiated with the 388 Mev protons of the circulating beam of the Nevis Cyclotron. Fractions corresponding to the elements scandium through gallium were chemically separated, and radionuclides were identified by counting with a Geiger tube. In total, the yields of 28 isotopes, varying in mass from $A = 43$ to 73, were obtained. The distribution of these products is consistent with a process that is evaporation controlled, and the conclusion is drawn that the primary fission products must have been highly excited. No preferred mode of fission was observed. (auth)

7537

RADIOCHEMICAL INVESTIGATION OF THE PRODUCTS OF SPALLATION AND FISSION NUCLEAR REACTIONS FROM THE EXPOSURE OF BISMUTH TO PROTONS OF 660 MEV ENERGY. A. N. Murin, B. K. Preobrazhenskii, and N. E. Titov (Khlopin Radium Inst.). *Izvest. Akad. Nauk S.S.S.R. Otdel. Khim. Nauk*, No. 4, 577-85(1955) July-Aug. (In Russian)

7538

ON PROCESSES OF STAR FORMATION AND FISSION RESULTING FROM THE EFFECT ON TUNGSTEN AND BISMUTH NUCLEI OF PROTONS WITH 460 MEV ENERGY. N. A. Perfilov and V. I. Ostroumov (Khlopin Radio Inst.). *Doklady Akad. Nauk S.S.S.R.* **103**, 227-8(1955) July 11. (In Russian)

7539

ON THE QUESTION OF ANGULAR DISTRIBUTION OF FRAGMENTS FROM FISSION OF URANIUM AT HIGH EXCITATION ENERGIES. O. V. Lozhkin, N. A. Perfilov, and V. P. Shamov. *Doklady Akad. Nauk S.S.S.R.* **103**, 407(1955) July 21. (In Russian)

7540
FISSION OF URANIUM NUCLEI BY FAST PROTONS. V. I. Ostroumov (Khlopin Radium Inst.). *Doklady Akad. Nauk S.S.S.R.* 103, 409-11(1955) July 21. (In Russian)

7541
ON THE INTERACTION OF FAST DEUTERONS WITH NUCLEI. E. L. Feinberg (Lebedev Physics Inst.). *Zhur. Eksptl. i Teoret. Fiz.* 29, 115-20(1955) July. (In Russian)

7542
A STUDY OF THE NUCLEAR DISINTEGRATIONS PRODUCED BY 950 MEV PROTONS. W. O. Lock and P. V. March (Univ. of Birmingham, England) and R. McKeague (Queen's Univ. of Belfast, Ireland). *Proc. Roy. Soc. (London)* A231, 368-78(1955) Sept. 6.

Nuclear disintegrations produced in the heavy nuclei of Ilford G 5 photographic emulsions by 950-Mev protons have been analyzed in detail. The characteristics of the disintegrations observed can be explained in terms of a simple model which assumes that a substantial fraction of the π mesons created is reabsorbed in the parent nucleus and that the energy of these mesons contributes mainly to the excitation energy of the residual nucleus. (auth)

7543
A REMARK ON THE INTERACTION OF THE SECOND KIND. Tetz Yoshimura (Tokyo Univ. of Education). *Progr. Theoret. Phys. (Japan)* 13, 336-8(1955) Mar.

It is generally believed that the multiple production of elementary particles would occur in the high-energy region if there were interactions of the second kind, characterized by $\eta > 0$. An investigation of the properties of the so-called unrenormalizable interactions of the second kind in connection with the possibility of multiple production is conducted. (D.E.B.)

7544
PROTON CAPTURE GAMMA RAYS FROM THE REACTION $P^{31}(p,\gamma)S^{32}$ LEADING TO THE GROUND AND FIRST EXCITED STATES OF S^{32} . E. B. Paul, H. E. Gove, A. E. Litherland, and G. A. Bartholomew (Atomic Energy of Canada Ltd., Chalk River, Ont.). *Phys. Rev.* 99, 1339-44(1955) Sept. 1.
Resonances in the reaction $P^{31}(p,\gamma)S^{32}$ which show transitions to the ground or first excited state of S^{32} have been studied for proton energies between 0.68 and 2.35 Mev. Angular distributions have been measured at resonances at 0.816, 0.825, 1.117, 1.146, 1.248, 1.892, 1.985, 2.027, 2.120, 2.320, and 2.340 Mev. These distributions along with the $P^{31}(p,\alpha)Si^{28}$ results enabled assignments of 1^- to be made for the resonances at 1.892, 2.027, and 2.120 Mev, of 1^+ for those at 0.825, 1.117, 1.985, 2.320, and 2.340 Mev, and of 2^+ to that at 1.248 Mev. Partial widths for γ_0 and γ_1 were also measured and are compared with theory. Analysis of the angular distributions at one resonance suggests that the spin of the first excited state of S^{32} at 2.25 Mev is 2^+ . The reduced proton widths for the three resonances with $J = 1^-$ together amount to 60% of the single-particle width. (auth)

7545
GAMMA RADIATION FROM THE INTERACTION OF 4.4-MEV NEUTRONS WITH Fe^{54} AND Fe^{56} . Rolf M. Sinclair (Westinghouse Research Labs., East Pittsburgh). *Phys. Rev.* 99, 1351-2(1955) Sept. 1.

The gamma radiation from the interaction of 4.4 ± 0.1 Mev neutrons with naturally occurring iron has been compared with that from a sample enriched to 34% Fe^{54} . The methods used for detection of gamma rays from small samples and

the shielding of the NaI detector are described. The results show that the well-known 0.85-Mev gamma ray comes from Fe^{56} , and that Fe^{54} emits a gamma ray of energy 1.40 ± 0.02 Mev. The ratio of the cross section for production of this 1.40-Mev radiation to that of the 0.85-Mev is 0.62 ± 0.07 at 4.4-Mev neutron energy, and 0.68 ± 0.10 at 3.9 Mev. The 1.40-Mev gamma ray is tentatively assigned to the reaction $Fe^{54}(n,n')Fe^{54*}(\gamma)Fe^{54}$, and is believed to represent the de-excitation of the first excited state. (auth)

7546
MECHANISM OF THE REACTION $C^{12} + p \rightarrow p + 3\alpha$ AT 29 MEV. John L. Need (Univ. of California, Berkeley). *Phys. Rev.* 99, 1356-66(1955) Sept. 1.

A methane-filled expansion cloud chamber, operated at $1/3$ atmosphere, was used to study the $C^{12} + p \rightarrow p + 3\alpha$ reaction. Two hundred events that satisfied momentum and energy conservation were accepted for analysis. One hundred forty-eight of these had all four prongs visible; the remaining fifty-two had only three visible prongs with the fourth prong directed into an invisible region of the chamber. One-quarter of the events proceeded via the Be^8 ground state and at least one-half via the 2.9-Mev level in Be^{8*} ; possibly higher levels in Be^8 were also involved. Evidence for the participation of levels in C^{12} at 9.6, 16, 20, and 25 Mev was found. There is evidence that the $C^{12}(p,\alpha)B^8$ reaction also participates, with levels at 0 and 3.2 ± 1.0 Mev. The possibility of the $C^{12} + p \rightarrow Li^5 + Be^8$ reaction was investigated and it was concluded that it could account for at most 5% of the events. At least one example of the $C^{13}(p,d)3\alpha$ reaction was seen. (auth)

7547
MIRROR REACTIONS $H^3(d,n)He^4$ AND $He^3(d,p)He^4$. D. P. Hale and R. D. Present (Univ. of Tennessee, Knoxville). *Phys. Rev.* 99, 1366-7(1955) Sept. 1.

Experimental data for these two reactions in the low-energy region from 64 to 954 kev (center-of-mass) have been analyzed assuming only (1) a well-defined nuclear surface, (2) charge symmetry, and (3) a single entrance channel. The one-level resonance formula was not used in this work. The results indicate consistency over the entire energy range between experiment, the hypothesis of charge symmetry, and basic assumptions of reaction theory. (auth)

7548
 $T(p,\gamma)He^4$ REACTION. J. E. Perry, Jr. and S. J. Bame, Jr. (Los Alamos Scientific Lab., N. Mex.). *Phys. Rev.* 99, 1368-75(1955) Sept. 1.

The $T(p,\gamma)He^4$ reaction has been studied over the proton energy range 0.1 to 6.2 Mev, by detecting the gamma rays with a sodium iodide scintillation counter. The 90° excitation function rises to a maximum in the region of 4 to 5 Mev and drops off slightly at higher energies. The angular distribution, measured at four energies, shows that in addition to the $\sin^2\theta$ distribution previously reported there is a small asymmetry about 90° of the form $\sin^2\theta \cos\theta$, which increases with proton bombarding energy. This asymmetry has been studied over the entire energy range. Absolute yield measurements of the reaction give a 90° differential cross section at 1 Mev at 3.65×10^{-30} cm² per steradian, which is considerably lower than has been previously reported. (auth)

7549
DISINTEGRATION OF CARBON INTO THREE ALPHA PARTICLES BY 12-20 MEV NEUTRONS. G. M. Frye, Jr.,

L. Rosen, and L. Stewart (Los Alamos Scientific Lab., N. Mex.). *Phys. Rev.* **99**, 1375-84(1955) Sept. 1.

The reaction $C^{12}(n,n'\alpha)$ has been studied in C-2 emulsions exposed to fifteen discrete neutron energies in the range 12.3 to 20.1 Mev. Measurements were made of the range and space angles of the three alpha particles for over 2000 events. The observed cross section is 78 ± 15 mb at 12.6 Mev, goes through a broad maximum of 265 ± 47 mb at 16.9 Mev, and is 223 ± 40 mb at 20.1 Mev. It was found that not all the events are observed in the emulsion since (a) one prong may be too short and (b) two prongs which arise from the ground state of Be^8 may not be resolvable. A correction is made for these missed stars at four points giving: $\sigma_{corr} = 190 \pm 50$, 230 ± 50 , 316 ± 73 , and 283 ± 59 mb at the bombarding energies of 12.9, 14.1, 15.5, and 18.8 Mev, respectively. Evidence is found for the excitation of the 9.6-Mev level in C^{12} and the ground state and 3-Mev level in Be^8 , so that at least some of the events disintegrate via the mode $C^{12}(n,n')C^{12*}(\alpha)Be^{8*}(2\alpha)$. Six events appear to involve the 7.7-Mev level in C^{12} . The center-of-mass energy spectrum of the scattered neutrons may be fitted by a four-particle phase space distribution or a Maxwellian distribution. As a result of these measurements, carbon stars in nuclear track plates may be used as a neutron monitor with an accuracy of 15% at 14 Mev and 20% elsewhere in the 12 to 20 Mev range. (auth)

7550

ANGULAR DISTRIBUTIONS FOR $Ti^{46,48}(d,p)Ti^{47,49}$ REACTIONS WITH 4.16-MEV DEUTERONS. L. L. Lee, Jr. and Waldo Rall (Yale Univ., New Haven, Conn.). *Phys. Rev.* **99**, 1384-6(1955) Sept. 1.

Angular distributions of protons resulting from reactions of Ti^{46} and Ti^{48} with 4.16-Mev deuterons have been measured in the forward direction for several levels of the residual nuclei. For protons from the 1.35- and 1.70-Mev states of Ti^{49} the distributions show a peak at an angle about 5° larger than that expected from simple deuteron-stripping theory. The reaction to the ground state of Ti^{47} appears to proceed largely through the compound nucleus at this deuteron energy. The measured angular distribution of protons from the 1.40-Mev excited state indicates an assignment of $L = 1$ for the captured neutron, hence odd parity and spin $\frac{1}{2}$ or $\frac{3}{2}$ to the level in Ti^{47} . (auth)

7551

PROTON-NEUTRON THRESHOLD MEASUREMENTS. J. D. Kington, J. K. Bair, Hans O. Cohn, and H. B. Willard (Oak Ridge National Lab., Tenn.). *Phys. Rev.* **99**, 1393-6(1955) Sept. 1.

New values for the (p,n) thresholds of N^{15} , Mg^{25} , Mg^{26} , Cu^{63} , and Cu^{65} are, in corresponding order, 3776 ± 8 , 5289 ± 25 , 5200 ± 10 , 4213 ± 8 , and 2170 ± 5 kev. The value given for Mg^{26} is for the transition to the first excited state in Al^{26} . In the process of providing an energy calibration curve for the magnetic analyzer of the Oak Ridge National Laboratory 5.5-Mv Van de Graaff, it was found that the resonances in the $F^{19}(p,\gamma)O^{16}$ reaction reported by others at 1355 and 1381 kev actually occurred at proton energies of 1347 ± 2 and 1374 ± 2 kev, respectively. Previous measurements on the (p,n) thresholds of F^{19} , Na^{23} , and Al^{27} , which were based in part on these resonances as calibration points, have been repeated, giving 4240 ± 8 , 5053 ± 10 , and 5792 ± 10 kev, respectively. (auth)

7552

HIGH-ENERGY FISSION OF HEAVY ELEMENTS. NUCLEAR

CHARGE DEPENDENCE. Paul Kruger and Nathan Sugarman (Univ. of Chicago). *Phys. Rev.* **99**, 1459(1955) Sept. 1.

Radiochemical studies of the fission of heavy elements ($_{67}Ho^{165}$ to $_{90}Th^{232}$) with 450-Mev protons have been performed. Radioactive nuclides varying in mass number from 59 to 115 were isolated from the various targets and, from their measured cross sections, the cross section vs. mass number dependence was determined on the assumption of a yield vs. charge distribution curve constant with mass number of the fission product and atomic number of the target nucleus. The integrated fission cross sections, in barns were calculated to be 0.67, 0.21, 0.061, 0.019, 0.005 and ~ 0.002 for thorium, bismuth, gold, rhenium, tantalum, and holmium, respectively. Anomalies in the cross section and most probable charge values for the heavier nuclides isolated from holmium suggest the existence of another competing process, labelled "fragmentation," along with spallation and fission. The importance of this process in heavy element bombardment is discussed. (auth)

7553

HIGH-ENERGY FISSION OF BISMUTH. PROTON ENERGY DEPENDENCE. Luis G. Jodra and Nathan Sugarman (Univ. of Chicago). *Phys. Rev.* **99**, 1470-4(1955) Sept. 1.

Radiochemical studies of the fission of bismuth with protons of 75 Mev to 450 Mev have been performed. Radioactive products ranging from Cu^{61} to Cs^{131} were isolated and their cross sections were measured. Integration of the calculated cross section vs. mass number curves for the various energies yielded values for the fission cross section which increase rapidly from a value of 0.016 b at 75 Mev to 0.12 b at 192 Mev, then more slowly to 0.20 b at 450 Mev. The most probable fission products decrease in mass and in neutron to proton ratio as the proton energy increases. (auth)

7554

REACTION $p + p \rightarrow \pi^+ + d$ WITH POLARIZED PROTONS. F. Mandl and T. Regge (Univ. Rochester, N. Y.). *Phys. Rev.* **99**, 1478-83(1955) Sept. 1.

The reaction $p + p \rightarrow \pi^+ + d$ is analyzed. Using the statistical operator methods, the production cross section for s-, p-, and d-wave mesons for the case of a polarized proton beam, and the polarization of the deuteron for both polarized and unpolarized incident protons are derived. With the restriction to s- and p-waves, the deuteron polarization gives new information about the production amplitudes; for an unpolarized proton beam for the p-wave production only for a polarized one for s-waves as well. The possibilities of measuring the deuteron polarization, and the relation of the phases of the production amplitudes to the pp-scattering phases are discussed. (auth)

7555

HEAVY PARTICLE STRIPPING. L. Madansky and George E. Owen (Johns Hopkins Univ., Baltimore). *Phys. Rev.* **99**, 1608-9(1955) Sept. 1.

The $Be^8(\alpha,n)C^{12}$ and $B^{11}(d,n)C^{12}$ reactions are chosen to illustrate the possibility that stripping can occur in nuclei other than the deuteron. Computed angular distribution of neutrons from $Be^8(\alpha,n)C^{12}$ reactions are shown, illustrating heavy particle stripping. Also, the angular distribution of the neutrons from $B^{11}(d,n)C^{12}$ is shown, illustrating a reaction in which both deuteron and heavy particle stripping can occur. (B.J.H.)

556

PHOTOPROTON-PROTON COINCIDENCES FROM VARIOUS NUCLEI. R. M. Weinstein (Brandeis Univ., Waltham, Mass. and Massachusetts Inst. of Tech., Cambridge) and A. Odian, C. Stein, and A. Wattenberg (Massachusetts Inst. of Tech., Cambridge). *Phys. Rev.* 99, 1621-2(1955) Sept. 1.

Proton-proton coincidences produced in Li, O, Al, and Cu by a 340-Mev synchrotron beam were observed. Data are tabulated, and possible reaction mechanisms are discussed. (B.J.H.)

ARTICLE ACCELERATORS

557 CERN-PS/MM-19

European Organization for Nuclear Research, Geneva]. *PROCEDEMENTS POLAIRES DE COMPENSATION. ETUDES PRELIMINAIRES.* [Polar Compensation Winding. Preliminary Studies]. July 1955. 14p.

Measurements made of the field index of several proton synchrotron electromagnet models indicate that three distinct regions exist. In the regions of low and high fields, the field index does not have its ideal value, and, in order to correct the situation, the use of polar compensation windings was investigated. (B.J.H.)

558 55-RL-1314

General Electric Co. Research Lab., Schenectady, N. Y. 300-MEV NONFERROMAGNETIC ELECTRON SYNCHROTRON. W. B. Jones, H. R. Kratz, J. L. Lawson, D. H. Miller, R. D. Miller, G. L. Ragan, J. Rouvina, and H. G. Vorhies. July 1955. 51p. Contract N7onr-332.

An electron synchrotron is described that is capable of accelerating electrons to energies of 300 Mev. It has been in operation for some time at the Research Laboratory, General Electric Company. This machine uses no iron to produce the magnetic guide field. Electrons are injected at an energy of 100 kv, accelerated to 4 Mev by betatron action, and to 300 Mev by synchrotron action. The magnetic fields for the betatron and synchrotron guide fields are produced directly by large currents flowing in coils suitably disposed near the electron orbit. The orbit diameter is 48 in. and a field of 16,000 oersteds at the orbit is produced by a current pulse with an amplitude of 26,000 amp. The entire coil system, together with the r-f resonator and injector, are located in a vacuum. The repetition frequency is 15 pulses/sec, and the x-ray beam from an internal target has an intensity of about 2×10^{10} equivalent quanta/min through a collimator which transmits about 60% of the total beam. (auth)

559

CURRENT REGULATOR FOR VAN DE GRAAFF MAGNET. Edwin J. Rogers (Brookhaven National Lab., Upton, N. Y.). *Electronics* 28, No. 10, 151-3(1955) Oct.

A Van de Graaff electrostatic generator is used to accelerate protons to an energy of 3.6 Mev before they enter the Cosmotron. The energy level of the protons is determined by the field strength of the Van de Graaff magnet and must be held constant to within 0.02 %. The current regulator for the magnet is described. Voltage and current feedback loops control the output of an amplidyne generator. A filtering system removes hash, ripple, and slip-frequency components. A circuit diagram is given. (M.P.G.)

RADIATION ABSORPTION AND SCATTERING

7560 NP-5765

Pittsburgh. Univ. Sarah Mellon Scaife Radiation Lab. ANGULAR CORRELATION OF TWO-QUANTUM ANNIHILATION IN CONDENSED MATERIALS. Technical Report No. II [for] Period March 1, 1955-April 30, 1955 [on] RESEARCH AND DEVELOPMENT ON STUDY OF POSITRONIUM AND MAGNETIC MOMENT OF THE ELECTRON. L. A. Page, M. Heinberg, O. J. Wallace, and T. W. Trout. Aug. 1955. 15p. DA Project No. 599-01-004. Contract DA-36-061-ORD-396.

Positron annihilation is being studied in apparatus similar to that of DeBenedetti et al. with the addition of slits to shield the gamma detectors from the 5-mc Na²² source. A narrow component has been isolated in fused quartz, comprising about 20% of the total annihilations, with width-at-half-maximum no greater than 3×10^{-3} radian. Other materials having the long lifetime component as listed by Boll and Graham, exhibit an angular distribution similar to fused quartz, while materials listed as having no long lifetime have, by comparison, a structureless distribution. To date, from data at room temperature, the former group is fused quartz, teflon, polystyrene, polyethylene, paraffin, and lucite; the latter group is crystalline quartz, aluminum, magnesium, copper, and graphite. Preliminary magnetic quenching experiments increase the amount of narrow component by applying a strong field to fused quartz and teflon but give no observable change for crystalline quartz. Quantitative comparison of this effect with expectation based on measured lifetimes and percentage long-life component will be made. (auth)

7561

ELASTIC SCATTERING OF PROTONS, DEUTERONS, AND ALPHA PARTICLES FROM HEAVY ELEMENTS. H. E. Gove (Massachusetts Inst. of Tech., Cambridge). *Phys. Rev.* 99, 1353-5(1955) Sept. 1.

The elastic scattering of 7.8-Mev protons from Au¹⁹⁷, 27.5-Mev alpha particles from Au¹⁹⁷, and 15.2-Mev deuterons from Pb²⁰⁸ and Bi²⁰⁹ has been measured as a function of angle. Except for the proton scattering which bears a constant ratio to Coulomb scattering, the cross sections when plotted as a ratio to the Coulomb cross sections fall sharply below unity at an angle of about 50° for the alpha particles on gold and about 30° for the deuterons on lead and bismuth. The absolute cross section for elastic scattering of 15.2-Mev deuterons from gold at 30° is equal to the Coulomb value within 20%, the energy variation is proportional to E⁻² from 15.2 to 8.5 Mev to within 6%, also at 30°. (auth)

7562

ELECTRON SCATTERING ON TUNGSTEN AT 31, 40, AND 60 MEV. R. W. Pidd and C. L. Hammer (Univ. of Michigan, Ann Arbor). *Phys. Rev.* 99, 1396-1400(1955) Sept. 1.

The cross section for electron scattering by heavy nuclei is model-independent at energies below 60 Mev. The angular distributions of electrons scattered by tungsten at 31, 40, and 60 Mev are self-consistent and give a uniform-model radius equal to $(1.18 \pm 0.10)A^{1/3} \times 10^{-13}$ cm. (auth)

7563

DETERMINATION OF THE EFFECTIVE CROSS SECTION FOR LOSS OF ELECTRONS BY IONS OF ATOMIC NITROGEN IN THE ENERGY RANGE 485 TO 1180 KEV. M. I. Korsunskii, L. I. Pivovarov, A. M. Markus, and Kh. L. Leviant

(Kharkov Physico-Technical Research Inst.). Doklady Akad. Nauk S.S.S.R. 103, 399-402(1955) July 21. (In Russian)

7564

DETERMINATION OF THE EFFECTIVE DIAMETER FOR LOSS OF ELECTRONS BY LI AND Na IONS IN THE ENERGY RANGE 80 TO 250 KEV. Kh. L. Leviant, M. I. Korsunskii, L. I. Pivovarov, and I. M. Podgornyi (Physico-Technical Inst., Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 103, 403-5(1955) July 21. (In Russian)

7565

TENTH-VALUE THICKNESSES FOR GAMMA-RAY ABSORPTION. John Moteff (General Electric Co., Cincinnati). Nucleonics 13, No. 7, 24(1955) July.

Useful data in graph form for shielding calculations are given. Included are graphs of tenth-value thicknesses, energy at which narrow-beam absorption coefficients are a minimum, and flux equivalent to 1 r/hr. (D.E.B.)

7566

PRODUCTION OF NEGATIVE OXYGEN IONS BY COLLISION OF POSITIVE OXYGEN IONS WITH GAS MOLECULES. Ya. M. Fogel and L. I. Krupnik (Physico-Technical Inst., Ukrainian Academy of Sciences). Zhur. Eksptl'. i Teoret. Fiz. 29, 209-20(1955) Aug. (In Russian)

A mass-spectrometric study of the capture of electrons by atomic and molecular oxygen ions by collision with H_2 , O_2 , and N_2 molecules is reported. Cross sections for these processes were measured for O ions with energies from 14 to 41 kev. (G.Y.)

RADIATION EFFECTS

7567 NYO-6513

Massachusetts Inst. of Tech., Cambridge.
X-RAY STUDY OF RADIATION DAMAGE [COVERING PERIOD JANUARY 1, 1955-JUNE 30, 1955]. B. E. Warren. July 20, 1955. 4p. Contract AT(30-1)-858.

The Huang effect in the Cu_3Au alloy was determined from measurements of reflection intensities from quenched and well ordered samples. A new method was developed for obtaining the scattering factor and the Debye factor in powder patterns. Attempts were made to estimate the stacking fault probability in cold worked Cu. (C.W.H.)

7568

NEUTRON IRRADIATION EFFECTS UPON YOUNG'S MODULUS AND INTERNAL FRICTION OF COPPER. D. O. Thompson, D. K. Holmes, and T. H. Blewitt (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 26, 1188(1955) Sept.

The adiabatic Young's modulus and internal friction of a set of Cu single crystals have been measured before and after a series of neutron irradiations. Within the range of flux values employed, irradiation has produced increases in the modulus and decreases in internal friction. Data for the crystals tested are presented. (D.E.B.)

7569

RADIATION STABILITY OF PLASTICS AND ELASTOMERS. C. D. Bopp and O. Sisman (Oak Ridge National Lab., Tenn.). Nucleonics 13, No. 7, 28-33(1955) July.

Data on how radiation affects plastics and elastomers show a rough relationship between radiation stability and Young's modulus. Generally, mineral-filled and rigid plastics are most stable, and natural rubber resists damage better than the synthetics. Addition of butyl rubber, which softens when

irradiated, to natural rubber, which hardens, gives a product with irradiated strength inferior to that of natural rubber. (auth)

RADIOACTIVITY

7570 CEA-337

France. Commissariat à l'Énergie Atomique, Paris.
TABLE DE DISTRIBUTION DES PERIODES DES NOYAUX RADIOACTIFS. [Half-Life Distribution Table of Radioactive Nuclei]. P. Gugenberger. June 20, 1954. 8p.

Tables are given of the half-life distribution of radioactive nuclei. Included in the table are the mass numbers, charge numbers, and the type of decay. (B.J.H.)

7571

COBALT-60 FIELD IRRADIATION MACHINE. Otto A. Kubik, W. Ralph Singleton, and Bernard Manowitz (Brookhaven National Lab., Upton, N. Y.). Nucleonics 13, No. 7, 42(1955) July.

A description of a 1600-C Co⁶⁰ field irradiation machine capable of dose rates up to 5000 r/hr is given. (D.E.B.)

7572

RADIOACTIVE-SOURCE CORRECTIONS FOR BREMSSTRAHLUNG AND SCATTER. S. J. Wyard (Guy's Hospital Medical School, London). Nucleonics 13, No. 7, 44-5(1955) July.

Where it is necessary to correct for bremsstrahlung and scatter, both the intensity and spectral distribution are required. Formulas and tables are presented for obtaining this information. (D.E.B.)

7573

MILLICURIE β -RAY POINT SOURCE. Oswald U. Anders (Univ. of Michigan, Ann Arbor). Nucleonics 13, No. 7, 46(1955) July.

Procedures for the preparation of a mc β -ray point source (<0.04 in. diameter) are given. A circular disk, somewhat less than 1-in. diameter, was cut from 0.04 in. thick Lucite sheet, which stops most of the weak Sr⁹⁰ β rays and permits Y⁹⁰ betas to penetrate. (D.E.B.)

7574

RADIATIONS FROM Sb¹²². B. Farrelly, L. Koerts, N. Benzer, R. van Lieshout, and C. S. Wu (Columbia Univ., New York). Phys. Rev. 99, 1440-5(1955) Sept. 1.

The radiations from Sb¹²² were investigated by use of a magnetic solenoid spectrometer, a coincidence scintillation spectrometer, and a proportional counter spectrometer. Three β^- groups are present with end-points 1970 ± 5 , 1400 ± 10 , 740 ± 20 kev. The highest energy β groups exhibits an α shape and the two lower β groups have allowed Kurie plots. Gamma-ray investigations showed that four gamma rays of energies 566 ± 4 , 686 ± 4 , 1137 ± 6 and 1260 ± 6 kev could be associated with the decay of Sb¹²². Coincidence techniques related the 1150-kev γ ray with the K-capture side and also showed that the 566- and 686-kev γ rays are in cascade. The ratio of (K + L) capture relative to total β^- emission was found to be 3.1%. The ratio of K capture to the excited state of Sn¹²² and K capture to the ground state was found to be 1:2.1. The intensities of all radiations are listed and the ft-values for various transitions calculated. An upper limit of 10^{-3} is placed on the positron emission. (auth)

575

RADIATIONS FROM LONG-LIVED $\text{Tc}^{(98)*}$. Seymour Katcoff (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. **99**, 18-19(1955) Sept. 1.

The decay characteristics of a sample of Tc from Ru subjected to intense neutron irradiation were established by coincidence experiments performed with a gray-wedge scintillation spectrometer. On the basis of the radiations and, a tentative mass assignment of 98 was given to the sample. (B.J.H.)

576

ON THE QUESTION OF ROTATIONAL LEVELS AND SPECTRA OF HEAVY NUCLEI. II. S. G. Ryzhanov (Leningrad State Univ.). Zhur. Eksptl'. i Teoret. Fiz. **29**, 7-9(1955) Aug. (In Russian)

The complex decay scheme $\text{ThC}(\text{Bi}^{212}) \xrightarrow{\alpha} \text{ThC}''(\text{Th}^{208})$ is discussed to illustrate the theory. 2 figures. (G.Y.)

577

INTERNATIONAL COMPARISONS OF THE CANADIAN PRIMARY RADIUM STANDARD. W. S. Michel and G. N. White (National Research Council, Ottawa, Ont., Canada). Can. J. Phys. **33**, 521-8(1955) Sept.

The content in milligrams of radium element of the Canadian primary radium standard was measured relative to the certified weight of a primary standard of the United States by an ionization method. The problem of correcting for differences in the attenuation of the gamma radiation in the body of each source is important, since the standards differ greatly in shape; a method of making this correction is described. Other intercomparisons involving the Canadian standard are discussed, and a mean value for the content of the standard is derived from these comparisons. The agreement between this and the certified value is satisfactory. (auth)

578

DIFFUSION CHAMBER OBSERVATION OF A SHORT-LIVED RADIOACTIVE GAS. John J. Heilemann (Ursinus Coll., Collegeville, Penna.). Am. J. Phys. **23**, 384(1955) Sept.

Tracks were observed in a diffusion cloud chamber after production of a carnotite sample. It was suggested that the tracks resulted from α ejection in rapid succession from parent and daughter elements in the actinium series. (B.J.H.)

579

NUCLEAR MATRIX ELEMENT FOR β -DECAY AND THE RATIO OF COUPLING CONSTANTS. Jun-ichi Fujita (Univ. of Tokyo). Progr. Theoret. Phys. (Japan) **13**, 260-4(1955) Mar.

The nuclear matrix elements for the β decay in the second and third forbidden transitions are derived on Bohr's collective model. The results are used for determining the ratio of the scalar and the tensor coupling constants in the analysis of the β decay of Rb^{87} , Cs^{137} , Tc^{99} and Fe^{59} , in terms of a linear combination of the scalar and the tensor Fermi interactions. (auth)

580

ON THE β - γ ANGULAR CORRELATIONS OF Tm^{170} AND Sb^{124} . VT INTERACTION. Yusuke Kato (Univ. of Tokyo) and Masato Morita (Kobayasi Inst. of Physical Research, Tokyo). Progr. Theoret. Phys. (Japan) **13**, 276-84(1955) Mar.

The β -ray angular distribution functions $F_{LL}^m(\theta)$ for the interference between different types of the Fermi interactions in the second forbidden transition have been calculated, taking into account the effect of the nuclear charge to the

emitted electron. The investigation of the β - γ angular correlation is performed in the case of Tm^{170} , assuming the linear combination of vector and tensor interactions. With this combination, the formulas for β - γ angular correlation for Sb^{124} are also given. (auth)

SPECTROSCOPY

7581 AD-48534

OBSERVATIONS REGARDING THE QUESTION OF SPECTRAL-LINE BROADENING. (Bemerkungen zur Frage der Verbreiterung von Spektrallinien). B. Trumpy. Translated by James Gough, Jr. from Z. Physik **53**, 57-60(1929). 7p.

Spectral line broadening is described, and it is suggested that an interaction between collision and radiation is a cause of line broadening. (M.P.G.)

THEORETICAL PHYSICS

7582 AEC-tr-2243

THE APPLICATION OF MARKOV'S METHOD TO THE PROBLEM OF MULTIPLE LOSSES. V. V. Chavchanidze. Translated from Zhur. Eksptl'. i Teoret. Fiz. **26**, 179-84(1954). 7p.

It is shown that the Markov method (equivalent to the characteristic-function method) permits reducing the problem of finding the distribution functions of the energy losses by a charged particle, experiencing multiple collisions with atoms of matter, to the performance of two successive quadratures. In view of the manner in which the Markov method reflects the actual physical nature of the processes involved, it may be affirmed that this method has definite advantages over the conventional method of formulating kinetic equations. (auth)

7583 AEC-tr-2245

ON THE PROBLEM OF DISTRIBUTION FUNCTIONS FOR SYSTEMS WITH COULOMB INTERACTIONS. E. A. Strel'tsova. Translated from Zhur. Eksptl'. i Teoret. Fiz. **26**, 173-8(1954). 6p.

Integral equations for molecular distribution functions for systems with Coulomb forces are derived and solved in explicit (closed) form. The solution of the problem is based on application of the methods (developed by N. N. Bogoliubov) of asymptotic expansion in powers of a specially selected small parameter. (auth)

7584 TT-542

SYMMETRICAL THEORY OF THE ELECTRON AND THE POSITRON. (Teoria Simmetrica Dell'elettrone e del Positrone). Ettore Majorana. Translated by D. A. Sinclair from Nuovo cimento (8), **14**, 171-84(1937). 22p.

The possibility is demonstrated of achieving a complete formal symmetry in the theory of the electron and the positron, making use of a new process of quantization. The meaning of Dirac's equations is somewhat modified thereby and there is no longer any reason to speak of negative states of energy; nor is there any reason to assume the existence of "antiparticles" for other types of particles, corresponding to the "holes" of negative energy. (auth)

7585

ON THE DEVELOPMENT OF THE COMPOUND NUCLEUS MODEL. Eugene P. Wigner (Princeton Univ., N. J.). Am. J. Phys. **23**, 371-80(1955) Sept.

The cross sections of certain nuclear reactions, as functions

of energy, show sharp maxima and low values between the maxima, thus exhibiting a great similarity to line spectra. The compound nucleus theory was originally designed to explain this structure and to describe the corresponding nuclear reactions. After a brief description of the picture which the compound nucleus theory presents for these reactions, the story of the extension of the theory to describe a wide variety of reactions is presented. This includes an outline of the mathematical concepts which the extended theory uses. The last part of the article deals with the connection between the so-called principle of causality, which expresses the fact that the scattered particle wave cannot leave the nucleus before the incident particle wave has reached it, and the formulas of the generalized compound nucleus theory. (auth)

7586

WAVE FUNCTIONS FOR NUCLEAR SHELL THEORY BY A VARIATION METHOD. Martin G. Redlich (Univ. of Wisconsin, Madison). *Phys. Rev.* **99**, 1421-6(1955) Sept. 1.

A system of A nucleons with two-nucleon-potentials $V(i,k)$ acting between each pair of them is taken as a model for the nucleus. A variation method for obtaining the best approximation to the wave function of this system as a linear combination of a given set of functions, ψ_1, \dots, ψ_q , is presented. In view of the evidence for shell effects, each ψ_α is assumed to describe A identical particles moving in a central field V' . In general, the amplitudes of only a small number of ψ_α are large. For central Gaussian interaction $V(i,k)$ and a harmonic oscillator potential V' , this method can account for the binding energy of one neutron in O^{17} , but not for the total binding energy of O^{16} . The model is compared with a spectroscopic one for a double closed shell core plus outer nucleons. (auth)

7587

PROBLEM IN SHOWER THEORY (APPROXIMATION A). R. C. O'Rourke and A. Anderson (Naval Research Lab., Washington, D. C.). *Phys. Rev.* **99**, 1484-90(1955) Sept. 1.

The Bhabha-Heitler method for solving the shower equations in approximation A is applied to the problem of showers initiated by a primary spectrum of photons. Numerical results have been obtained, by using the Naval Research Electronic Computer, for the practical case of a primary spectrum of the familiar high-energy bremsstrahlung shape. (auth)

7588

SIMPLE NONRELATIVISTIC MODEL FOR SINGLE MESON PRODUCTION. D. A. Geffen (Massachusetts Inst. of Tech., Cambridge). *Phys. Rev.* **99**, 1534-41(1955) Sept. 1.

Single pseudoscalar meson production is assumed to be described by a transition matrix element taken between initial and final two-nucleon wave functions defined as solutions to Schrödinger's equation with a phenomenological potential included. The effective interaction is a linear combination of the two possible nonrelativistic invariants. The angular distribution and energy dependence is considered in detail for the reaction $p + p \rightarrow \pi^+ + d$. Using the Jastrow potential to define the proton wave functions, the large anisotropy can be explained by including the D state of the deuteron. Results become less satisfactory at increasing energies. The predicted energy dependence of the total cross section for proton beam energies from 311 to 515 Mev agrees well with experiment. The strong dependence of the cross section on the incident proton momentum contributes to the agreement. An order of magnitude estimate of the

alternate reaction, $p + p \rightarrow \pi^+ + n + p$, predicts, at 340 Mev (laboratory system), a branching ratio slightly greater than one. Finally, the absorption rate of π^- mesons by deuterons from a K-shell orbit, i.e., $\pi^- + d \rightarrow 2n$, is calculated. This gives an estimate of the strength of the S meson wave part of the interaction and is consistent with the restrictions imposed by the results obtained for the reaction $p + p \rightarrow \pi^+ + d$ (auth)

7589

WAVE EQUATION FOR SPIN 0 IN HAMILTONIAN FORM. K. M. Case (Univ. of Michigan, Ann Arbor). *Phys. Rev.* **99**, 1572-3(1955) Sept. 1.

It is shown that the Hamiltonian form for spin 1 particles also describes spin 0 particles if the 5-dimensional representation of the Duffin-Kemmer algebra is used. (auth)

7590

RELATIVISTIC CORRECTIONS FOR HIGH-ENERGY p-p SCATTERING. G. Breit (Yale Univ., New Haven, Conn.). *Phys. Rev.* **99**, 1581-96(1955) Sept. 1.

It is shown that the treatment of the collision of two charged particles by means of a first-order Born approximation and Møller's matrix element involves an inconsistency connected with the infinite cross section for small angle scattering. It is then shown that an energy formula derived the two-body interaction by means of an early form of the Heisenberg-Pauli quantum electrodynamics makes it possible to construct a relativistic two-body extension of the non-relativistic one-body Mott-Gordon solution. This extension is good only to order e^2 but arguments are given for believing that the angle-dependent and e^2 -containing factors are partially correct for the more important terms. The Gordon sphere construction naturally leads to such factors and the consideration of small angle collisions in the laboratory system leads to a similar result. The latter suggests the possible existence of correction terms. The explicit superposition of partial waves is avoided by noting a formal similarity of the relativistic and nonrelativistic problems for principal non-spin-dependent terms. Contributions of the spin-dependent terms are worked out, also avoiding explicit summation by employing a momentum space representation and noting that once the main terms are taken care of by the Gordon sphere construction, the spin-dependent terms can be treated as a perturbation on account of their more rapid fall off with distance. The possibility of dealing with first-order phase shifts by means of a phase shift matrix and the coupling of states with different L but the same J are discussed. The definition of phase shifts in the relativistic problem, neglecting meson production, is discussed. (auth)

7591

PHASE SHIFTS FOR RELATIVISTIC CORRECTIONS IN HIGH-ENERGY p-p SCATTERING. M. E. Ebel and M. H. Hull, Jr. (Yale Univ., New Haven, Conn.). *Phys. Rev.* **99**, 1596-9(1955) Sept. 1.

Scattering phase shifts for the relativistic corrections to the ordinary Coulomb interaction between two protons are calculated in the first Born approximation. The scattering matrix resulting from these phase shifts is obtained and shown to agree with the results of the preceding paper. (auth)

7592

ELECTROMAGNETIC PROPERTIES OF THE DEUTERON. M. Sugawara (Royal Inst. of Tech., Stockholm, Sweden). *Phys. Rev.* **99**, 1601-2(1955) Sept. 1.

Exchange current corrections to the deuteron magnetic a

quadrupole moments have been calculated, assuming ps-ps theory, employing Tamm-Dancoff formalism, and retaining only up to one-meson amplitudes. The numerical values were estimated by using some reasonable deuteron wave functions. It is shown that the S-D cross term is the dominant term and the effect of the change of normalization is always very big, making the whole correction to the deuteron magnetic moment always negative. The relativistic and the nonadditivity corrections to the deuteron moments have also been estimated under the same approximation. The over-all correction to the magnetic moment is shown to be negative and the final estimate of the deuteron D-state probability is $3 \pm 1\%$. (auth)

7593
ISOTOPIC SPIN AND THE GROUP SPACE OF THE PROPER LORENTZ GROUP. E. J. Schremp (Naval Research Lab., Washington, D. C.). *Phys. Rev.* **99**, 1603(1955) Sept. 1.

By a slight modification of the algebraic foundations of spin- $1/2$ theory, isotopic spin is incorporated therein, in a natural and irreducible manner. The method of approach proceeds from a consideration of the geometry of the group-space of the proper Lorentz group. (auth)

7594
CHARGE INDEPENDENCE THEORY OF V PARTICLES. Kazuhiko Nishijima (Osaka City Univ., Japan). *Progr. Theoret. Phys.* (Japan) **13**, 285-304(1955) Mar.

Based on the charge independence hypothesis the properties of V particles are theoretically investigated. It is found that the curious behaviours of these unstable particles are most simply interpreted in terms of the η -charge conservation law which directly results from the charge independence hypothesis and suitable isotopic spin assignments to these particles. (auth)

7595
CONDITION OF CAUSALITY IN THE QUANTUM THEORY OF FIELDS. N. N. Bogolyubov. *Izvest. Akad. Nauk S.S.R., Ser. Fiz.* **19**, 237-46(1955) Mar.-Apr. (In Russian)

7596
RELATION BETWEEN POLARIZATION SCATTERING, AND SPIN-ORBITAL COUPLING IN QUASICLASSICAL APPROXIMATION. I. I. Levintov (Inst. of Chemical Physics). *Doklady Akad. Nauk S.S.R.* **103**, 215-18(1955) July 11. (In Russian)

Scattering of high-energy nucleons is treated. (G.Y.)

7597
ON THE ASYMPTOTIC GREEN FUNCTION OF THE NU-

CLEON AND MESON IN PSEUDOSCALAR THEORY WITH WEAK INTERACTION. A. D. Galanin, B. L. Ioffe, and I. Ya. Pomeranchuk. *Zhur. Eksptl'. i Teoret. Fiz.* **29**, 51-63(1955) July. (In Russian)

7598
TOWARD A THEORY OF QUANTUM FIELDS. I. E. S. Fradkin (Lebedev Physics Inst.). *Zhur. Eksptl'. i Teoret. Fiz.* **29**, 121-34(1955) July. (In Russian)

7599
ON THE QUESTION OF INTERPRETATION OF THE DIRAC EQUATION FOR THE ELECTRON. G. A. Zaitsev. *Zhur. Eksptl'. i Teoret. Fiz.* **29**, 176-80(1955) Aug. (In Russian)

7600
ON CERTAIN GENERAL RELATIONSHIPS IN QUANTUM ELECTRODYNAMICS. E. S. Fradkin (Lebedev Physics Inst.). *Zhur. Eksptl'. i Teoret. Fiz.* **29**, 258-61(1955) Aug. (In Russian)

URANIUM AND URANIUM COMPOUNDS

7601
THE FISSION YIELDS OF ISOTOPES OF XENON AND KRYPTON IN THE NEUTRON FISSION OF U^{235} AND U^{238} . R. K. Wanless and H. G. Thode (McMaster Univ., Hamilton, Ont., Canada). *Can. J. Phys.* **33**, 541-54(1955) Sept.

Several uranium samples have been irradiated under various conditions in the Chalk River NRX reactor and in the Los Alamos fast reactor. The fission gases, xenon and krypton, have been extracted from the irradiated material and the relative isotopic abundances determined mass spectrometrically. Fine structure in the mass-fission yield curve has been found in both the xenon and krypton mass ranges for $U^{235} + n$ and $U^{238} + n$ fission. It is observed that this fine structure shifts to lower masses, as predicted, for neutron fission of U^{238} . The proportions of U^{235} and U^{238} fission that have occurred in the irradiated samples have been estimated from the percentage change in fine structure. (auth)

7602
IN URANIUM DRAMA, CHEMICAL PROCESS PLAYS STAR ROLE. *Chem. Eng.* **62**, No. 10, 112-14(1955) Oct.

A description of the process of converting U ore to U metal at the plant of the National Lead Co. of Ohio is presented. (J.E.D.)

